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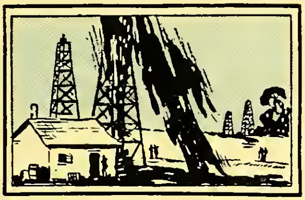
Louisiana Conservation REVIEW



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ANNUAL REVIEWS
1932
of
FORESTRY, MINERALS,
RESEARCH DIVISIONS.

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Articles Correlating
by
Professor Robert Glenk
Professor Henry V. Howe
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APRIL
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Louisiana Conservation Review

Published quarterly by the Department of Conservation in the interest of protection and proper utilization of Louisiana's natural resources.

JAMES P. GUILLOT........Editor
N. E. SIMONEAUX......Assoc. Editor

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An Unwarranted Attack Answered

IN an editorial published in the Shreveport Journal, of Shreveport, La., January 4th, 1933, the accuracy of certain explanatory statements under an illustration in the Tenth Biennial Report of the Department of Conservation is questioned. The statements in the Department of Conservation publication are absolutely accurate.

Upon analysis, this editorial may be resolved into two questions, first, whether or not the name White Perch is known to be applied to the Gaspergou, (*Aplodinotus grunniens*); second, whether or not the Gaspergou is a palatable food fish. These questions will be discussed in the same order.

First, is the name White Perch known to be applied to the Gaspergou?

The standard check list of North American fishes, a volume of some 670 pages is the Check List of the Fish and Fish-like Vertebrates of North and Middle America, by Jordan, Evermann and Clark, published by the United States Bureau of Fisheries, Washington, D. C., in 1930. In this authoritative work, White Perch is listed as one of seven common names of the Gaspergou, (Section 2734, Page 352).

Forbes and Richardson, whose work on fresh water fishes is recognized as one of the classics on the subject, give White Perch as one of the four common names of the Gaspergou (Page 323).

Meek and Hildebrand, recognized as foremost ichthyologists, give White Perch as one of the four common names of the Gaspergou (Page 335).

Furthermore, in the "Statistical Report of the Fisheries of the Gulf States," by Collins and Smith, published by the United States Bureau of Fisheries, Washington, D. C., there appears a list of the "Common and Scientific Names of Important and Commercial fishes of the Gulf States." This list gives White Perch as a "local common name" (Page 100) in the Gulf States for the Gaspergou

Still further, Coker, in his authoritative account of the Mississippi River fishes states (Page 209) the Gaspergou is "often known and marketed as White Perch."

Forbes and Richardson, speaking of the Gaspergou (Page 324) state "in the Ohio Valley, in the South, and to some extent on the Illinois River, it is known and marketed as the White Perch."

It is unnecessary to cite further proof that White Perch is accepted by the leading authorities as one of the popular names for the Gaspergou.

As a matter of fact, White Perch is a common name given to five different species of North American fishes, one the Gaspergou, Aplodinotus grunniens; two members of the Sunfish family, Pomoxis annularis, Pomoxis sparoides; one a member of the White Bass family, Morone americana; and one a Western species, a Surffish, Hyperprosopon argenteus. The whole problem of popular names is a difficult one and the policy followed in the recent publications of the Department of Conservation has been to cite the various popular names so that the sharply localized differences will be met. The writer of this editorial was evidently quite unfamiliar with the fact that popular names themselves are of most uncertain usefulness. Thus, Gaspergou, the most generally used name for the species in Louisiana, means absolutely nothing to the fisherman in Illinois, while Croaker, an additional name for Gaspergou in Illinois, means quite a different fish in Louisiana. The editorial writer has made the mistake of deciding that the Gaspergou and all White Perches are regarded as the same fish, whereas the statement that was made that White Perch is one of the names applied to the Gaspergou is absolutely correct. The writer need merely further refer to the fact that our common Sac-a-lait, Pomoxis annularis, has twenty-four common names while our familiar "Green Trout" (not a Trout at all) the Large-mouth Black Bass, Huro floridana, has received no less than forty-four popular names.

Returning now to the question of the value of Gaspergou as food, this value was recognized by that earliest of Louisiana naturalists, Lepage Du Pratz, in his Histoire de la Louisiane, published back in 1758, when he wrote of it, "its flesh, though delicate, is very firm." The qualities of the Gaspergou as food vary with the food which it eats and with age. The writer, on one occasion where a controversy concerning the food qualities of the Gaspergou had arisen, was one of those who partook of Gaspergou properly prepared and everyone present declared it to be excel-

(Continued on Page 49)

PRESIDENT'S MESSAGE

"IT is essential to our recovery program that measures immediately be enacted aimed at unemployment relief. A direct attack in this problem suggests three types of legislation.

"The first is the enrollment of workers now by the federal government for such public employment as can be quickly started and will not interfere with the demand for the proper standard of normal employment.

Grants to State

"The second is grants to states for relief work.

"The third extends to a broad public work labor-creating program.

"With reference to the latter, I am now studying the many projects suggested and the financial questions involved. I shall make recommendations to the Congress presently.

"In regard to grants to states for relief work, I advise you that the remainder of the appropriation of last year will last until May.

"Therefore, and because a continuance of federal aid is still a definite necessity for many states, a further appropriation must be made before the end of this special session.

"I find a clear need for some simple federal machinery to co-ordinate and check these grants of aid. I am, therefore, asking that you establish the office of federal relief administrator, whose duty it will be to scan requests for grants and to check the efficiency and wisdom of their use.

Conservation Corps

"The first of these measures which I have enumerated, however, can and should be immediately enacted. I propose to create a civilian conservation corps to be used in simple work, not interfering with normal employment and confining itself to forestry, the prevention of soil erosion, flood control and similar projects. I call your attention to the fact that this type of work is of definite, practical value, not only through the prevention of great financial loss, but also as a means of creating future national wealth.

"This is brought home by the news we are receiving today of vast damage caused by floods on the Ohio and other rivers.

"Control, and direction of such work can be carried on by existing machinery of the Departments of Labor, Agriculture, War and Interior.

"I estimate that 250,000 men can be given temporary employment by early summer if you give me authority to proceed within the next two weeks.

"I ask no new funds at this time. The use of unobligated funds, now appropriated for public works, will be sufficient for several months.

"This enterprise is an established part of our national policy. It will conserve our precious national resources. It will pay dividends to the present and future generations.

Moral Value

"It will make improvements in national and state domains which have been largely forgotten in the past few years of industrial development.

"More important, however, than the material gains will be the moral and spiritual value of such work. The overwhelming majority of unemployed Americans, who are now walking the streets and receiving private or public relief, would infinitely prefer to work. We can take a vast army of these unemployed out into healthful surroundings. We can eliminate to some extent at least, the threat that enforced idleness brings to spiritual and moral stability. It is not a panacea for all the unemployed but it is an essential step in this emergency. I ask its adoption.

FRANKLIN DELANO ROOSEVELT
President of the United States

Conservation of Resources and Utilization of Industrial Waste Products

By ROBERT GLENK,
Curator, Louisiana State Museum

MR. JOHN D. ROCKEFELLER, when asked the question, not so ago, if the possibility of making large fortunes in the United States had passed with the more or less completed development of the natural products of the country, replied that he did not believe that wealth made from exploiting natural resources could compare in greatness with the fortunes to be made in the future by the utilization of waste material through scientific treatment.

Our prosperity in the past has been largely based on cheap land and superabundant raw materials.

Ever since Louisiana became part of the United States, it has been designated as "a land of exceeding wealth." All this time, however, Louisiana was merely furnishing raw material which, if manufactured into commercial products, would have brought much greater wealth through greatly enhanced values.

Although agriculture is properly regarded as a basic industry, the money value of its product in the more progressive countries is greatly exceeded by that of manufactures.

Industry looks to agriculture for much of its raw material, and the farm is correspondingly dependent upon the factory for fertilizer, insecticides, agricultural machinery and home supplies.

It is no doubt true that one-half of the number of farmers that we now have could supply all the needs of our people for farm products for food.

It is essential, therefore, if the farmer is to become prosperous, that a far wider use of the products of the farm must be developed by their utilization for other than food purposes.

Wide awake organizations in many of the states are aware of this fact, and have developed important new and extended uses for their crops through scientific treatment.

Lemon and Orange Waste Products Utilized

The California Fruit Growers Exchange has increased the consumption of citrus fruits by using the excess production in the manufacture of lemon oil, citric acid, citrate of lime and orange peel oil, under American conditions with machinery and mass production superceding the laborious hand methods of Europe.

The lemons, or oranges, as the case may be, are run in a continuous stream into a convoluted bronze machine which massages the fruit and finally crushes it, producing a flow of juice which washes down the spray of oil and carries it through a strainer and into a centrifugal separator.

Within fifteen minutes from the time the fruit enters, this separator gives a perfectly clear and highly colored oil with none of the fragrance impaired. The oil commands a good price and the juice is shipped in refrigerator cars to distributing points, where it is sold for use in orange drinks. One plant utilized forty thousand tons of cull lemons; producing two million pounds of citric acid, thirty thousand pounds of pectin and sixty-five thousand pounds of lemon oil. Another plant, working with ten thousand tons of surplus oranges, produced fifty thousand pounds orange oil valued at $100,000.00 from what was formerly waste product.

Farm Wastes

The huge piles of waste straw and cornstalks, accumulated on our farm lands and frequently burned to get rid of the material, will in the future be turned to account and be an added source of income to the farmer.

The principal farm by-products are cornstalks, corn cobs, cereal straws, rice and oat hulls, cane bagasse and peanut shells, cotton stalks, cottonseed hulls.

In gross tonnage these by-products constitute 60% of the crops annually produced from the soil. These by-products are, of course, not wholly wasted at present. Their value is appreciable as feed for livestock or as fertilizer, also as material for paper stock.

Lignin, a complex substance with many industrial potentialities possibly equalling those of coal-tar, constitutes 30% of all dry material found in vegetation. The annual production of this material in the United States is estimated at forty million tons. Most of this is wasted.

When destructively distilled under reduced pressure, methyl alcohol, acetone, acetic acid, phenols, eugenol and guaiacol are obtained; these have important applications in chemical industry. Synthetic resins for the manufacture of paints and lacquers are also obtainable from Lignin.

By the action of steam and acid on rice and oat hulls, Furfural is produced. Not so long ago this product was a chemical curiosity, now it is manufactured and sold in tank car lots. It is commercially used as a substitute for formaldehyde in the preparation of artificial resins and as an antiknock substance in gasoline, and may even supplant gasoline as a motor fuel. It is used as a weed killer along the railroad tracks and for many other purposes.

The use of cornstalks for the manufacture of wallboard, newspaper, alpha cellulose, and as absorbents for various purposes, is already established on a commercial scale.

FOREST RESOURCES

Louisiana has supplied her full share of forest products towards the world's progress and was able for a long time to maintain a high rank among the states as a producer of lumber.

Investigations conducted by the Forest Service have led to the statement that, "only 25% of our present producing forest is saw timber." A conservative estimate of the waste incurred is fifty billion feet of wood. Of course, not all of this waste is an absolute loss. Slabs and edgings are, to a limited extent, used in making excelsior, etc. Sawdust is used for packing, nonconductors and in plastics. Both are used for fuel in the mills.

If all the wood wasted in the yellow pine industry had been steam distilled for the production of wood turpentine, it would have yielded more than the total production of gum spirits of turpentine each year.

The manufacture of woodpulp originated in the United States and Americans invented most of the chemical processes for the making of paper from wood. From the invention of papyrus until about fifty years ago, all paper was made from crop plant fibres.

Naturally, chemical industries based on forest products are by-products industries, for nearly all woods are more valuable for timber than for their chemical constituents.

An interesting possibility for the use of sawdust lies in the use of hydrolyzed woodmeal as a carbohydrate cattlefood.

The manufacture of stock food from sawdust is advocated by the United States Forest Products Laboratory.

As in the production of Ethyl alcohol from wood, the cellulose is first converted to sugar by treatment with dilute acid under pressure. The solution is boiled down to a thick molasses and is mixed with the sawdust residue.

The results of feeding this woodmeal to cattle, in combination with natural foods to make a balanced ration, have been highly encouraging.

SUMACH

The leaves and branches of several sumach varieties are rich in tannin of a certain grade much in demand by tanners and dyers.

The sumach tannin is valuable for fine leathers for gloves, book bindings, etc., and gives a softness difficult to obtain with other tan material.

Louisiana has vast areas of native sumach which could be made into salable products.

The town of Mer Rouge in Morehouse Parish derives its name from the abundance of sumach formerly growing nearby making a veritable "Red sea" in the fall of the year.

Native sumach may not be able to replace entirely the imported Sicilian sumach which makes a very light colored tan, still the importation of sicilian sumach has fallen off considerably since Virginia began to supply the home grown product.

It is not too much to say that there is no known locality in the world where the natural resources are so combined as to make possible the production of soda, salt cake alkali, sulphuric acid and other chemicals at so low a cost as the section near the Gulf Coast of Louisiana and Texas.

With a practically inexhaustible supply of salt in the numerous salt domes, an assured supply of fuel in natural gas, petroleum and lignite and with unexcelled transportation facilities, enabling the chemical factory to ship and receive products to and from any port of the world, it would seem like an ideal location for such manufactures. There is no form of industry which adds so much to wealth with so little drain upon natural resources as the chemical industry, and the development of such industrial enterprises here in the near future is a foregone conclusion.

LIGNITE

Louisiana has very large areas of promising Lignite seams, many of which could be mined by the "open cut" method after removal of the surface layers.

Lignite is a low grade fuel and carries generally ten to fifty per cent moisture.

The utilization of Lignite in whatever form it may be is fundamentally important, and any new methods or uses that promise to develop this resource are deserving of careful study.

Several methods of approach to the Lignite problem are possible whereby salable products will help develop this latent source of energy and wealth.

First, distillation of Lignite at low temperature for the recovery of carbon and valuable gaseous and liquid by-products.

Second, Hydrogenation of Lignite for the production of light and heavy oils.

Third, complete gasification of Lignite for the production of Producer gas.

Fourth, production of smokeless fuel either brignetted or otherwise for household purposes.

(Continued on Page 22)

Annual Report Minerals Division of the State Conservation Department Year 1932

By J. A. SHAW,
Director, Minerals Division

IT may be authoritatively said that 1932 has been rather a turbulent year for the oil industry in Louisiana, especially the northern part, and no one has been in a better position to see and understand this chaotic condition better than the Minerals Division of the State Conservation Department located in Shreveport.

The year was ushered in with an overproduction of oil, or, rather an under consumption due to the nation wide financial depression; this condition was further aggravated by the enormous flush production of the world's largest producing field, East Texas, adjacent to Louisiana. The production from approximately 9,000 wells in this field, even with proration, made impossible the operation of small pumping wells in the older fields of Louisiana; consequently hundreds of these small paying wells had to be discontinued to keep from operating at a loss. Had they been shut down until such time as the price was again normal they could have in many instances operated at a small profit, even with exceedingly high lifting costs; but with only a thin margin of profit in sight for many months, and the demand for casing and equipment in the East Texas field being greater than the supply, the producers of small wells in Louisiana were content to salvage as much equipment from these wells as possible and remove it to East Texas for use in that field. This practice continued for the first several months of the year, and finally brought forth such vigorous protests from "Fee" and Royalty owners, that the Department was forced to make careful investigations and in some instances refuse permits for abandoning these wells. Practically all North Louisiana fields shared equally in this practice, with perhaps Haynesville and Homer leading the list. Cotton Valley, Caddo—Pine Island, Bull Bayou, Sarepta and many of the smaller fields all helped to bear their share of abandonments. But as the months passed and the price of oil came again into its own, these stripper wells were realized to be a source of revenue and the mad rush to abandon was forgotten, and today practically every small well in North Louisiana is being produced, much to the satisfaction of the property owners.

DR. J. A. SHAW

Fortunately, the natural gas industry did not suffer materially from a disrupted price structure or overproduction, and while comparatively few new wells have been added during the past year, the industry has kept rather an even keel. The only effect was caused by a decrease in the manufacture of carbon black. Because of the low market price of the product, without any change in the purchase price of Natural Gas, the manufacturers took advantage of their large reserves and supplied the demand from this source, rather than operate their plants at a loss. Some of the plants have kept up operations on a small scale in order that their reserves might not be entirely depleted. The Monroe and Richland fields have seen but very little activity along lines of new development, and while these fields are holding their own fairly well the prospect of a severe winter will no doubt have a telling effect upon them, and cause the drilling of additional wells in other producing fields. The Rodessa and Sugar Creek fields, producing from the Trinity, will no doubt be called upon to share the peak loads throughout the winter months. Sugar Creek, while on a comparatively small structure is capable of producing at least one hundred million cubic feet of gas per day, provided gasoline plants of sufficient capacity were constructed, and which would be necessary in case the field was called upon to supply the demand. Rodessa is in the same category, being unusually rich in gasoline. The Arkansas Natural Gas Company has just recently completed a 62½ million cubic foot producer in this area, which makes it look unusually promising as a future gas supply of the state.

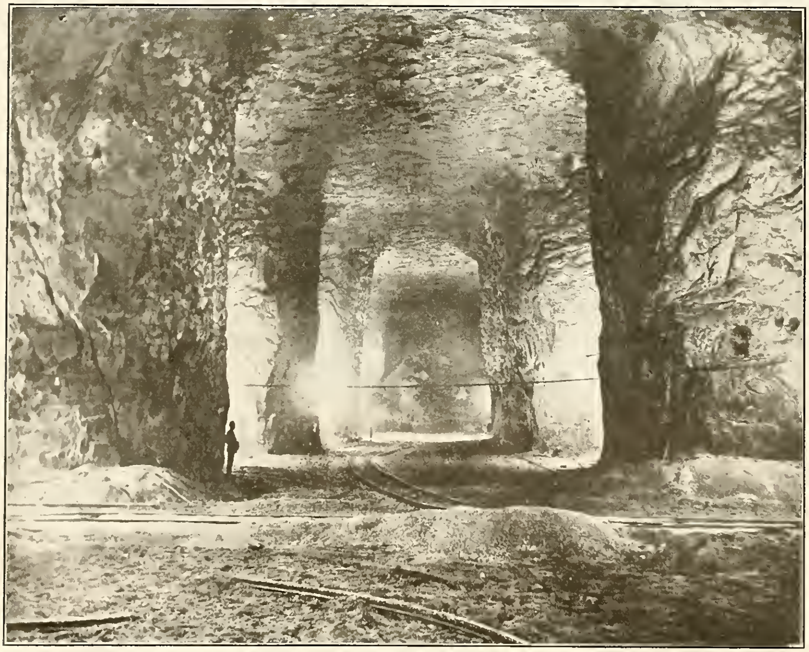
The Zwolle oil field has had "its ups and downs" as well, but has been responsible for maintaining the production standard for North Louisiana. It has averaged approximately one producing well out of each three drilled. The morale of the Zwolle operator has been raised greatly in the month just passed, due to the use of Muriatic acid treatment on the Chalk Rock Horizon. While the use of this acid had been known for some time and had been used on other chalk rock wells, it did not come into prominence until recently when the production on a certain well was raised from 19 barrels to approximately 700 barrels, and is now working miracles on other wells in that area. About 1,000 gallons of this acid is pumped or poured into the well and forced under pressure into the pores of the chalk formation. Laboratory experiments have shown that this amount of acid will dissolve approximately 12 cubic feet of limestone or chalk, which represents many lineal feet of enlarged drainage arteries around the well, thereby increasing both the oil and gas recovery. The use of this acid is becoming quite popular in this field and will without doubt be the salvation of the operator, and likewise contribute much in revenue to the state.

In addition to increased production through the use of acid treatment, it seems that the field cannot be placed within definite confines; for occasionally a new well is drilled into production that will either extend its production limits, or open up a new "Hot Spot" in what has been considered "dry territory." However, the field is extending generally eastward.

The Converse Area to the north of Zwolle, newly discovered by Gibson & Johnson, in their Frost—Johnson No. 1, gives promise of a new producing area. Leasing became very active and prices high; but as additional wells proved unpromising, it soon quieted down and its potentialities will depend entirely upon deeper drilling, or the effect of acid. This is however, anticipated in the near future.

Production in the discovery well came from a horizon between 1,500-1,600 feet, but to date has *not been definitely classified* other than Upper Cretaceous.

The Department placed an experienced Paleontologist on the scene and his co-operation with the operator and the service he rendered them was proof that the Department was an asset rather than a liability, and several letters were received complimenting the Director of the Minerals Division and requesting that this service be continued. Another important ruling with reference to locations was put into effect: viz.: that of making all locations 330 feet from property or



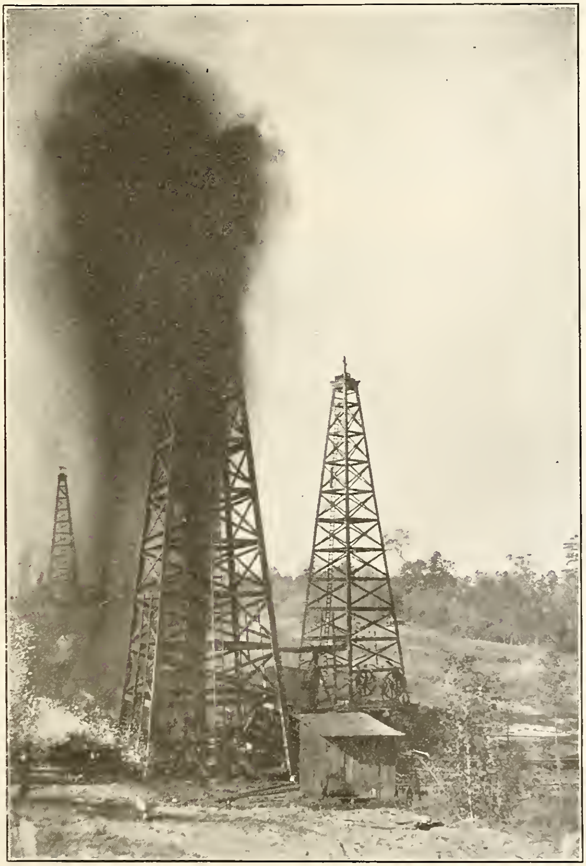
Interior view Avery Island Salt Mine, near New Iberia, Louisiana lease lines, where the size and shape of the tract would permit. This ruling met with some opposition in the beginning, but as the operator became more familiar with its significance he also became a staunch supporter of its enforcement.

This report is intended to convey a brief statistical outline of the Mineral Industry throughout Louisiana for the year of 1932, as well as the activities of the Minerals Division of the State Conservation Department for the same period. It has therefore for clarity and convenience been considered under various headings, viz: Oil, natural gas, natural gas gasoline, carbon black, sulphur, salt, pipe lines, engineering department and laboratory and paleontological department, together with appropriate tables for the subjects requiring them.

OIL

The status of the oil industry in Louisiana during 1932 is indicated by a comparison of drilling permits issued by the Minerals Division of the State Conservation Department. A total of 598 drilling permits were issued during 1932, against 330 in 1931, representing an increase of 81 per cent.

Of the total permits issued Sabine Parish accounts for 302, or slightly over 50 per cent of the total. Approximately 25 of these permits were issued for the Converse area, and were never drilled or are shut down at various depths awaiting further development. Cameron Parish followed next in order with 59 permits and Calcasieu ranked third with 31. It will be noticed that 57 Parishes out of the 64 had one or more drilling operations. The table included in this report gives an accurate list of permits issued for all operations.



The Usual Louisiana Gusher

Although one of the most unfavorable years during the period of financial and industrial depression, Louisiana produced 20,502,143 barrels of oil. This production will not for the purpose of this report be listed separately by fields, but will be considered separate for North Louisiana, South Louisiana and the outstanding field of North Louisiana, Zwolle. For example, North Louisiana produced 10,041,935 barrels, of which Zwolle produced 2,355,779 barrels. South Louisiana produced 10,460,208 barrels, and for the first time in history exceeded North Louisiana by nearly one-half million barrels. Zwolle failed to equal its 1931 production by 120,870 barrels, while several new fields as well as new producing horizons in some of the older fields were added to South Louisiana production. In April, 1932, the Pure Oil Company brought in a new producing area of Gueydan, in Vermilion Parish. Production is coming from a horizon at 4,029 feet, and has produced steadily upward until a peak of 45,000 barrels monthly has been reached. The month of December, however, has shown a temporary decline to 22,000 barrels in this field.

Lake Barre in Terrebonne Parish has unquestionably been the oustanding field in South Louisiana, having produced an average of one-fourth million barrels of oil per month throughout the year. It started the year with a production of 121,691 barrels per month, increased to 303,451 barrels in September, and closed the year with 263,442 barrels in December. This field is one of Coastal Louisiana's newly discovered fields.

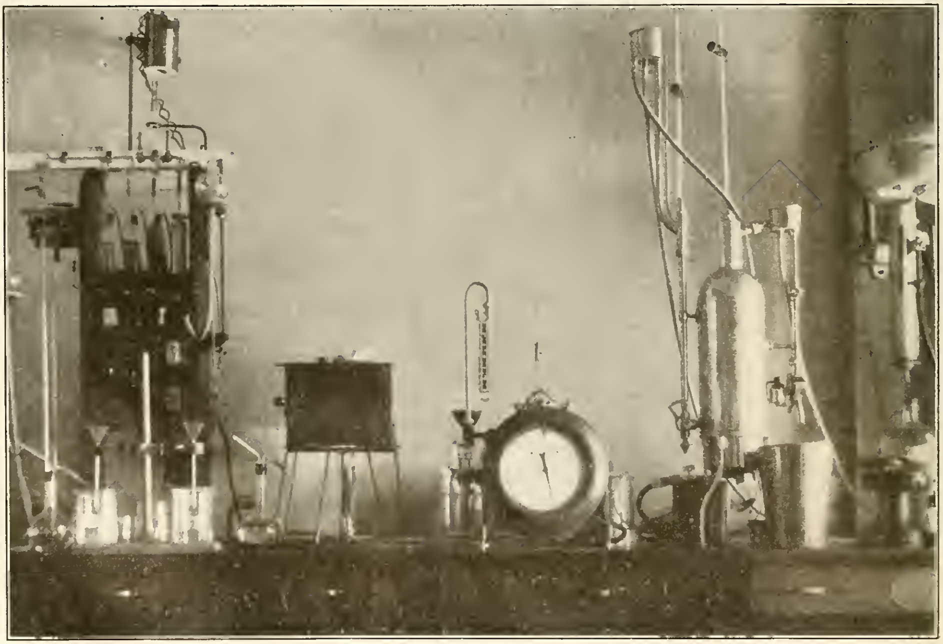
In May, 1932, the Shell Petroleum Company discovered new production on the Iowa Dome, which is situated on the line between Calcasieu and Jefferson Davis Parish. Production has averaged about 40,000 barrels per month from a depth of 7,000 feet.

The Rio Bravo Oil Company also brought in new production on the Darrow Dome in Ascension Parish. The discovery well was drilled in on September 25, 1932, flowing approximately 1,000 barrels per day. This production is coming from 4,035 feet.

The Cockrell-Moran Dome in Plaquemines Parish, another of South Louisiana's newest fields, increased its production throughout the year from 1934 barrels in January to 3,420 barrels in December, reaching a peak of 6,000 barrels during the month of May. Among the outstanding older fields of South Louisiana are East Hackberry in Cameron Parish and Sweet Lake (also in Cameron).

The Black Bayou District in Cameron has gradually declined in production from 41,000 barrels in January to 20,000 barrels monthly in December. Production on the Port Barre Dome in St. Landry Parish has gradually increased throughout the year from 20,000 to 80,000 barrels monthly, several new wells having been added. The Caillou Island and Dog Lake domes in Terrebonne Parish, which were discovered by the Louisiana Land and Exploration Company in 1929 and developed by the Texas Company in 1930, have been dropped from the list of producers; Caillou Island produced but 6,000 barrels during its life, while Dog Lake is credited with only 88 barrels. No doubt these domes will be exploited further, and may again be added to the list of producing fields.

With the exception of the Converse area, no new fields have been discovered in North Louisiana, although several very promising areas are in sight. The Benson Structure in the extreme southern part of De Soto Parish is exceptionally interesting, as on various other areas in the same parish, especially in the western part. All of Sabine Parish from the Zwolle Field north may be considered as potential oil territory. An area approximately 30 miles in width along the so-called Conroe trend from Conroe, Texas, through Louisiana to Jackson, Mississippi, is receiving much attention and practically the entire area is now, or soon will be, under lease. Several tests now drilling along this trend are being watched with intense interest. Beauregard, Vernon, Natchitoches, Rapides, Grant, and Avoyelles all have tests going down, which will afford much additional information upon the relative position of the trend and its localized structural features.



Section of Minerals Division Analytical Laboratory

Caddo, Bossier, Claiborne and several other North Louisiana Parishes are also receiving valuable tests, some of which are scheduled to go deep.

The settled production of the North Louisiana fields, all of which are comparatively old, has held up exceedingly well, and it is thought that the increased activity in search of new fields will without doubt add several to the list during the coming year.

NATURAL GAS

Though still holding an enviable position among the gas producing states, Louisiana has dropped to its lowest production since 1927. There is no doubt but that all the other gas producing states will show a similar decline for the same period, therefore no unusual amount of concern need be registered as to the potential reserves of the State; and should the demand for domestic and industrial gas become greater than the supply just so surely will Louisiana call upon her unlimited reserves to supply her quota.

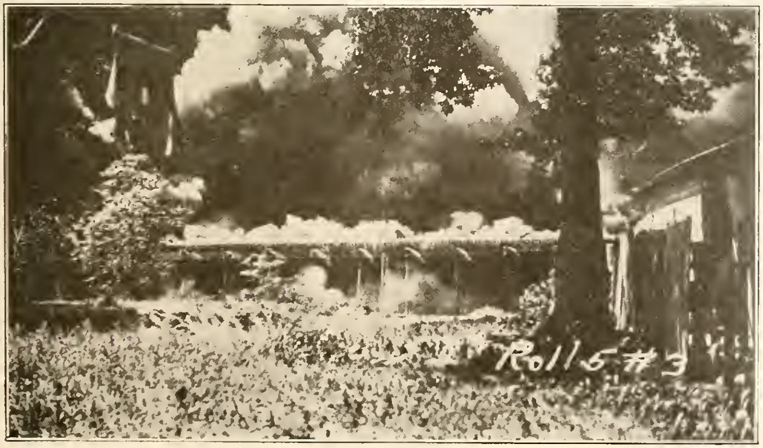
The year 1932 has seen only a slight decline in production according to a percentage basis; yet the decline expressed in terms of cubic feet seems astounding.

The state total production for 1931 was 222,471,691,000 cubic feet, against 194,000,874,000 cubic feet for 1932. This decrease reduced to a percentage, amounts to only 14.6 per cent. The carbon black industry can readily account for approximately 10 per cent of this decline, while a moderately mild winter in Louisiana and adjoining states is responsible for a further decrease. It is known that the distributing companies have not been called upon to deliver a peak load in this coastal area, while perhaps the 522 mile line to St. Louis and intermediate points has been carrying an excessive load due to an extremely cold winter in Northern Arkansas and Missouri. It can also be seen that because of the new Jackson, Miss., gas field, the load would be lessened on the line to Birmingham and Atlanta. Until the discovery of the Jackson Gas field, the Monroe and Richland fields were supplying the demand for both domestic and industrial consumption in that area.

While a total of 25 wells have been drilled in the parishes of Morehouse, Ouachita, and Union, but little new production has been added to the Monroe Field. The majority of these wells may be classified as "Wildcats" and drilled in widely separated areas in search of production apart from the Monroe Field. It is quite obvious that Monroe is holding its own wonderfully well against water encroachment, as but a total of 14 wells were abandoned during 1932. Considering that there are approximately 850 producing wells in this area alone, much credit seems due the Minerals Division and the operators for their strict observance and attempt to protect this field.

The Richland field has had but 3 new drilling operations during the entire year, while a total of 30 permits have been issued to abandon and pull casing. This fact would seem to indicate that the life of the field was threatened in certain places and which need not be surprising when considering the numerous craters that in the past destroyed so much of the field's reserve; there is also a noticeable amount of water encroachment in the outer wells, and those near the crater areas. Should the next few months indicate that the water condition is increasing, no doubt some remedial measure will be taken to prolong the life of the field. As the productive limits of the field is to a certain extent, outlined, no new extensions are anticipated, and it is doubtful if but few interior wells will be drilled.

The last closed pressure report issued by the Minerals Division in October, 1932, clearly shows the pressure decline in this field, varying from a few pounds on every well to 250 pounds on others. The Monroe field presents an entirely different picture; for



A Stubborn and Costly Oil Field Fire

while this field is considerably older than the Richland field, many of the wells register an increased pressure rather than a decline. The average closed in pressure for both Monroe and Richland is estimated at 500 pounds.

In addition to the Monroe and Richland fields, both Sugar Creek in Claiborne Parish, and Rodessa in Caddo Parish, give promise of an enormous supply. While Sugar Creek has added two unusually good wells to its list of producers, it has also added one near failure. Apparently this well was drilled slightly off structure and is in no way discouraging as to the possibilities of the field.

Rodessa, also producing from the Trinity Horizon has recently added a 62½ million cubic feet well to its production, which is also encouraging as a source of future supply. Both of these fields are comparatively new, and because of the high gasoline content, and an insufficiency of gasoline plant capacity, no heavy withdrawals have as yet been made upon them, in an effort to determine a decline curve toward the probable life of the fields.

The following table is given for the purpose of showing the Natural Gas Production from the several major gas fields:

METERED GAS PRODUCTION FROM RECOGNIZED GAS FIELDS—1932

Field	Parish	Metered Production Cu. Ft.	State Total Cu. Ft.
Monroe	Morehouse	16,411,413,000	
Monroe	Ouachita	50,797,605,000	
Monroe	Union	23,057,815,000	
			90,266,883,000
Richland	Richland	81,244,039,000	81,244,039,000
Sugar Creek	Claiborne	3,883,401,000	3,833,401,000
Rodessa	Caddo	1,272,839,000	1,272,839,000
All other fields		17,383,712,000	17,383,712,000
Total for State			194,000,874,000

ANNUAL REPORT OF MINERALS DIVISION, DEPARTMENT OF CONSERVATION, SHOWING BY PARISHES TOTAL NUMBER OF PERMITS FOR WELL OPERATIONS ISSUED DURING YEAR 1932

Parish	Drill	Deepen	Abandon	Side Track	Over Work	Temp. Abnd.	Shoot	Plug & Perf.	Plug Back	Total
Acadia	4	5	22	2	2	0	0	0	0	35
Ascension	6	1	2	1	0	0	0	0	0	10
Beauregard	1	0	0	0	0	0	0	0	0	1
Bienville	3	0	0	0	0	0	0	0	0	3
Bossier	10	3	101	0	0	0	0	0	0	114
Caddo	16	1	139	0	0	0	3	1	2	162
Calcasieu	31	21	21	3	2	16	0	0	0	94
Caldwell	0	0	0	0	0	0	0	0	0	0
Cameron	59	17	30	3	0	0	0	0	0	109
Claiborne	6	0	38	0	0	0	0	0	20	64
Concordia	1	0	0	0	0	0	0	0	0	1
DeSoto	17	1	19	0	0	0	0	0	0	37
W. Carroll	1	0	1	0	0	0	0	0	0	2
Evangeline	0	0	0	0	0	0	0	0	0	0
W. Feliciana	0	0	0	0	0	0	0	0	0	0
Franklin	0	0	1	0	0	0	0	0	0	1
Grant	3	0	0	0	0	0	0	0	0	3
Iberia	18	2	0	0	0	0	0	0	0	20
Iberville	2	0	9	0	0	0	0	0	0	11
Jackson	1	0	2	0	0	0	0	0	0	3
Jeff Davis	7	0	1	0	0	0	0	0	0	8
La Fourche	10	1	10	0	0	0	0	0	0	21
La Salle	0	0	12	0	0	0	0	0	4	16
Morehouse	5	0	3	0	0	0	0	0	0	8
Natchitoches	8	0	3	0	0	0	0	0	0	11
Ouachita	7	0	7	0	0	0	0	0	0	14
Plaquemines	15	0	10	0	0	0	0	0	0	25
Rapides	0	0	0	0	0	0	0	0	0	0
Red River	5	0	22	0	0	1	0	0	0	28
Richland	3	0	30	0	0	0	0	0	0	33
Sabine	302	3	56	0	0	2	2	2	7	374
St. Bernard	1	0	0	0	0	0	0	0	0	1
St. Landry	7	0	0	0	0	0	0	0	0	7
St. Martin	5	0	0	0	0	0	0	0	0	5
Tensas	0	0	0	0	0	0	0	0	0	0
Terrebonne	20	0	12	0	0	0	0	0	0	32
Union	13	0	4	0	0	0	0	0	0	17
Vermilion	4	1	0	0	0	0	0	0	0	5
Vernon	2	0	0	0	0	0	0	0	0	2
Webster	4	0	27	0	0	0	0	0	0	31
Winn	1	0	0	0	0	0	0	0	0	1
	598	56	582	9	4	19	5	3	33	1,306

NATURAL GAS—GASOLINE

There were in operation in North Louisiana during the past year, a total of 28 compression and absorption plants owned and located as follows:

Caddo
Gulf Refining Co.
Magnolia Petroleum Co.
Arkansas Nat. Gas Corp.
Stanolind Oil Company
The Texas Company

Haynesville
Arkansas Nat. Gas Corp.
Gulf Refining Company
Ohio Oil Company

Monroe
Arkansas Nat. Gas. Corp.
Century Carbon Company
Columbian Gasoline Corp.
J. Smylie Herkness
J. M. Huber & Co., Inc.
Peerless Carbon Company
United Carbon Company
United Gas Public Service Corp.

Cotton Valley
Louisiana Oil Refining Corp.
Magnolia Petroleum Company
Ohio Oil Company
United Gas Public Service Corp.

De Soto—Bull Bayou
The Texas Company
Magnolia Petroleum Company

Richland
Century Carbon Company
Columbian Gasoline Corp.
United Carbon Company
United Gas Public Service Corp.

SUGAR CREEK
Sugar Creek Syndicate, Inc.

These plants are divided somewhat equally between the Oil Producers, Gas Producers and distributors, and the Carbon Black manufacturers.

Those operated by the oil producing companies are for the purpose of extracting gasoline from the casing head gas produced by the oil wells.

All of the plants operated by the gas producing and distributing companies are of necessity for the extraction of gasoline from the gases before it is turned into the distribution system.

The Carbon Black manufacturers operate their own plants for the extraction of gasoline before the gas is burned to Carbon Black, as the greatest profit comes from the gasoline extracted, and it is also for that reason that the wet gas areas in the Monroe and Richland fields show the heaviest withdrawals.

Natural gas from the Monroe-Richland fields has conservatively averaged 200 to 250 gallons per million cubic feet, while the gas from the Trinity Horizon in Sugar Creek (Claiborne Parish) and the Rodessa Field in Northwest Caddo

Parish, is averaging 1500 to 1700 gallons per million.

The total gas—gasoline produced in Louisiana for the year 1932 amounted to 39,905,581 gallons or approximately one million barrels, distributed as follows:

	Gallons
Claiborne Parish (all fields including Sugar Creek)	7,330,566
Caddo Parish (all fields including Rodessa)	2,588,575
Webster Parish (all fields)	4,201,533
Richland Parish (Gas field)	21,208,158
Monroe Gas Field (Morehouse—Union & Ouachita)	4,391,801
De Soto—Red River	184,948
Total	39,905,581

It is quite noticeable that the Richland Gas Field produced 53 per cent of the total gasoline production from gas wells of the state, and likewise produced 41½ per cent of the state total of Natural Gas.

CARBON BLACK

The manufacture of Carbon Black for 1932 shows a slight decline from the preceding year. The industry produced 47,773,802 pounds in 1931 against 42,897,501 pounds for 1932 or a decrease of approximately 11 per cent.

The following table shows the distribution of plants and the amount of carbon black manufactured in each of the two fields, together with the amount of natural gas consumed in operation:

OWNERSHIP AND LOCATION OF PLANTS

Field	Lbs. Carbon Black Produced	Cu. Ft. Gas Consumed
Richland	7,544,881	6,480,935,000
Monroe	35,352,620	33,003,108,000
Total	42,897,501	39,484,143,000

Monroe Field

Century Carbon Company
J. Smylie Herkness
J. M. Huber Company, Inc.
Imperial Oil & Gas Products Co.
Keystone Carbon Company
Monroe-Louisiana Carbon Co.
Peerless Carbon Black Company
Southern Carbon Company
Texas-Louisiana Producing & Carbon Co.
Thermatomic Carbon Company
United Carbon Company

Richland Field

Century Carbon Company

If the slight decrease in the manufacture of Carbon Black in Louisiana is indicative of the manufacture of the product elsewhere, it would seem that the industry has not suffered so severely after all; for in spite of the nation wide depression, there seem to be just as many automobiles and printing plants in operation now as ever before; and so long as these two industries continue to thrive just so long will there be a demand for Carbon Black, for automobile tires and printers inks consume the major portion of this product.

It cannot be said that anyone of the plants has operated at full force since 1928 for since that year there has been a gradual yearly decline in plant output, and in 1931, the production dropped off 50 per cent over the preceding year. The production for 1932 is rather encouraging and without doubt the next year will find all plants operating at capacity once again.

SULPHUR

The production of Sulphur, which has been dormant in Louisiana since 1924, is again being added to the list of developed minerals.

The bed of Lake Peigneur, located about six miles west from New Iberia in Iberia Parish is now the scene of active sulphur production. Approximately forty-five wells have been drilled to the sulphur deposit 800 to 900 feet below the Lake bed, and have been equipped to produce in the same manner as those at Sulphur, viz: that of forcing super-heated water into the formation through one string of pipe, liquifying the sulphur crystals and returning the flow through another string. This method was discovered and used successfully by Herman Frosch at Sulphur, after many attempts at other methods had failed.

While the plant at Lake Peigneur has been in operation but a short time, it is reported to be very promising, and the year 1933 will no doubt see Louisiana listed again among the sulphur producing states.

The Black Bayou District in Cameron Parish, also promises to develop into a sulphur producing area as well as oil. Many interesting shows have been obtained, and the Union Sulphur Company and the Freeport Sulphur Company are thoroughly testing this area in an effort to develop it into commercial sulphur production.

The Freeport Sulphur Company is also exploring extensively for sulphur in Plaquemines Parish at Lake Grande Ecaille. The sulphur cap in this area is encountered at from 1170 feet to 1548 feet, or a thickness of from 200 to 350 feet. Operations in this area were commenced about May, 1932, and several wells have been drilled since that time, all of which are extremely promising. These discoveries can be attributed to the extensive Geophysical Exploration which took place in 1929, and which to date has proven perfect with but few exceptions.

Louisiana's outlook on the sulphur situation is indeed bright, and needless to say that with the return of prosperity, so will Louisiana return to her coveted place among the sulphur producing states.

SALT

So much is already contained in previous reports regarding the inexhaustible salt supply of Louisiana, that little remains to be said. The mines that are in operation today have such an abundance of salt in sight and have established themselves so solidly with the present market, that new investments seem very improbable. However, the new mine at Winnfield that entered the salt industry some time ago seems a thriving concern in the face of competition. No reports of production have been received for 1932 as yet, but no doubt the total production will approximate 550,000 tons, the present average market price of which is $2.50 to $3.00 per ton.

PIPE LINES

No new additions or extensions were made to Louisiana's pipe line system during 1932, except an occasional short line constructed to serve as a lateral or gathering line. Whether or not the present system would be adequate under trying conditions is doubtful, for rumors of lengthy trunk lines have been circulated in order that the present system might be completed throughout the state, and be prepared to transport gas back into the state to areas inaccessible from the present system. There is possibility of an East-West Line through south Louisiana within the next year or so, and which would serve many towns and villages that are now without gas.

ENGINEERING SECTION

The duties of the Engineering Department vary but little from year to year. The art of keeping abreast with all the new methods of oil production and equipment, the latest and best methods of high pressure gas well gauging and equipment, as well as being able to cope with the problems of independent and major operators, is quite a trying task, and requires an experienced and seasoned personnel.

A total of 1306 permits for well operations passed through this department during the year. Perhaps 50 per cent of these applications were incorrect when received in this office. To the average person, a description as to the location of a well means but little. But to the experienced Engineer or Geologist it is the one important thing that is directly responsible for a correct interpretation of structural mapping. Consequently all of these mistakes are caught by the Engineer and the applications are returned for corrections. Because of these positive requirements from the operator the department has today one of the most complete set of well records of any oil producing state, and such other states as are organizing similar departments have wholeheartedly adopted our system and accepted our suggestions and methods.

Many and varied matters are brought before the Engineer. He is classed in practically the same category as an Industrial Engineer for our various Chambers of Commerce. He is the medium through which new money is brought into the state for the development of its Mineral Resources. He must be familiar with the Mineral Resources in all phases, and be able to intelligently converse with representatives of industries who anticipate investments along these lines. Graphs and maps must be drawn in anticipation of numerous and varied requests of a general public in order to intelligently interpret and answer their many questions; statistical reports must be gotten out for reference, and to supply answers to inquiries from all corners of the continent: in general, the troubles of the operator in Louisiana are the troubles of the Engineer of the Minerals Division, and in the interest of the state approximately 75% of his time is required to tactfully and intelligently solve the problems of a general public.

During the past year many hundreds of such requests both by mail and personal contact have been cared for, and have been successful in bringing new money in the State, which may or may not mean additional revenues from severance tax. The coming year looks very promising and it is hoped that the earnest efforts of the Engineering Department have not been in vain.

LABORATORY AND PALEONTOLOGICAL DEPT.

The activities of this department have been confined largely to research and general laboratory work for both operators and prospectors interested in the Minerals of the state.

Among the outstanding accomplishments of this department was the compilation and publishing of a list of many available publications dealing with the Geology and Mineral resources of Louisiana and adjoining areas; and, in building up a fine fossil reference, mostly microscopic, on the formations of Louisiana, which have been penetrated by the drill in search for oil and gas. Much of this valuable information was gleaned from examinations of widely scattered well cores and cuttings throughout the state. This valuable publication must be attributed to Mr. Clarence P. Dunbar, former chemist and paleontologist for the department during the past two years, and is the most complete work of its kind that is available to the public. It is contained in the 1933 issue of a Minerals Division Handbook, Bulletin

(Continued on Page 22)

Waterfowl in Louisiana

By
HARRY C. OBERHOLSER

LOUISIANA is one of the most important waterfowl regions in the entire United States. Its geographical position on the Gulf of Mexico at the lower end of the Mississippi Valley is an unusually favorable circumstance that contributes to its attractiveness for waterfowl. The numerous lakes scattered over its interior, the wide and numerous stream valleys, and the great expanse of marsh land along the coast combine to make the State a paradise for ducks and geese. That the ducks and geese have not been slow to take advantage of these conditions is evident to anyone who is familiar with Louisiana.

Waterfowl constitute an important natural resource of any area in which they are abundant. Ducks and geese are one of the favorable objects of sport and recreation, and because of this they provide a very important source of revenue, not only on account of the state licenses necessary to hunters but also through the employment of local citizens in carrying on the sport of hunting. Any state, therefore, is wise that fosters the sport of hunting and provides means of protection for waterfowl so that there shall be no diminution either in the supply of birds or in the consequent interest of sportsmen in their pursuit.

The shallow reed-and-grass-bound lagoons of the marshes provide the haunts of most of the ducks and coots visiting the coast section of Louisiana.

As would naturally be expected in so favorable an area, the State of Louisiana has a great variety of waterfowl. Aside from the mottled duck, or, as it is called in this region, the summer mallard, which breeds on the prairies of the coast, and the wood duck, which breeds in the wooded swamps and along the rivers, the principal kinds of waterfowl that occur in Louisiana come here in the winter from the north. Although a few individuals of some of the species breed in the State, the great bulk of ducks and all of the geese entirely leave the State in the spring.

The geese that visit Louisiana in sufficient numbers to be of importance from a game standpoint are the blue goose, lesser snow goose or white brant, the white-fronted goose or specklebelly, the Canada goose, and the Hutchins goose. Of these by far the most numerous is the blue goose. In fact, a large part of the total number of this bird in existence is to be found in Louisiana during the winter season, and the protection and preservation of its wintering ground in this State will have a great deal to do with the perpetuation of this bird.

Of the ducks the most numerous and important are the pintail or sprig and the mallard. Others normally most frequent are the green-winged teal, blue-winged teal, canvasback, lesser scaup or dos gris, shoveller or spoon-bill, ring-necked duck or black jack, baldpate or widgeon, gadwall or gray duck. American golden-eye, and Eastern black duck. Less important from the sportsman's standpoint at the present time are the bufflehead, ruddy duck, redhead, greater scaup or blue-bill, hooded merganser, American merganser, and red-breasted merganser, the last three being commonly known as fish ducks. A few other ducks occur occasionally, but they are of little or no importance from the sportsman's standpoint.

The American coot, or as it is commonly called, the mudhen, while not a duck, is in general habits much more like a duck than it is like the rails, to which latter it is closely related. Furthermore, it is frequently associated with the various species of ducks in the marshes and on bodies of water.

While, therefore, the coot is not strictly a waterfowl it is often thought of and spoken of as though it were a member of this group. In many places it is much sought as an object of sport; and when living on the proper kind of food and properly prepared for the table it is as palatable as many ducks.

The ducks and geese that frequent the lakes and marshes of Louisiana during the winter season breed in the northern United States and Canada all the way from the Atlantic to the Pacific Ocean. Some species, like the mallard, the pintail, the green-winged teal, and the American golden-eye, have a wide breeding range in North America, both east and west. The Eastern black duck has an extensive range in Eastern North America from the middle United States northward; but many of the others, including some of the most important of our game birds, such as the canvasback, redhead, shoveller, blue-winged teal, and gadwall, are in general, more or less concentrated in the breeding season in the central portion of Canada south to the northern part of the Great Basin and Nebraska in the United States.

The Canada goose ranges in the breeding season well across Canada; the Hutchins goose is more limited in its range to certain portions of the eastern Arctic region, while the white-fronted goose and the lesser snow goose have a relatively wide range in the Arctic region of North America. The blue goose, on the other hand, is confined to a relatively limited area in the Arctic region of Eastern North America.

Since the great bulk of ducks and geese visits the lower Mississippi Valley only in winter, and Louisiana therefore forms their winter home, the supply of these birds each year is influenced to a considerable extent by conditions that obtain on the Northern breeding grounds during the previous season. So far as Louisiana is concerned, therefore, the citizens of this State have practically no control over the various factors that affect the welfare of the waterfowl before these birds reach the borders of this State. The most important of these factors are climate, natural enemies, drainage of breeding and feeding areas, and hunting. Over the first man has little or no control, but so far as drainage, enemies, and hunting are concerned human control to a considerable extent can be exercised.

Rainfall is of very great importance, since waterfowl, ducks particularly, are dependent largely on water areas for rearing their young; and a series of unfavorable rainfall conditions in the best waterfowl breeding areas might well, therefore, have a very serious effect on the waterfowl supply.

The natural enemies of ducks and geese are particularly active during the breeding season when the young birds are very much more easily destroyed than are the adults. Crows, gulls, foxes, and other predatory animals often take a

Myriads of wild geese and ducks are harbored each winter on the State's Wild Life Sanctuaries.

serious toll of the eggs and young, and under many local conditions form a considerable menace to the breeding birds, although under normal conditions this is often not a serious menace. In areas such as the prairie provinces of Canada where the crow has increased greatly as a result of the extension of agriculture it has been desirable to exercise some human control over the numbers of this bird, and wherever similar conditions exist with regard to the crow or other natural enemies of ducks some assistance can be given the waterfowl by proper methods of conservation.

The drainage of lakes, sloughs, and swamps for purposes of agriculture often operates very seriously to restrict the breeding areas that are suitable for waterfowl. Part of this restriction is due to the natural consequence of increased absorption on account of the tilling of the soil, and this, of course, is a condition difficult to remedy. The actual drainage of water areas has proceeded to so great an extent that the available breeding grounds are, in many parts of the western United States and southern Canada, now greatly restricted, and this shrinking of breeding areas is still progressing.

The legitimate hunting of ducks which has now become so wide-spread a sport is one that by all means should be preserved and encouraged, particularly for its recreation features. It is, however, naturally one of the drains on the waterfowl supply which were other conditions entirely satisfactory would not be so serious. Under the present circumstances, however, proper restrictions for its conduct are absolutely necessary if the birds, and, therefore, the sport, are to be preserved.

The years 1929, 1930, and 1931 were years of unusual drought in the central northern portion of the United States and in central southern Canada, the very regions that produce the greatest supply of waterfowl of many of the species that are important from a sportsman's standpoint. The disastrous effect of this condition has been clearly reflected in the greatly diminished numbers of waterfowl of most of the important species that in winter visit Louisiana. Of these birds the mallard and the pintail, having a wide and relatively undisturbed breeding range so far as drought is concerned, had by 1931 suffered little or not at all and appeared at least to be holding their own in numbers or even somewhat increasing. The same is true of the eastern black duck and of the Canada goose; also the blue goose, since the isolated and undisturbed summer home of the last-mentioned bird compensates in practical results for its more limited distribution. Many of the others, conspicuously the canvasback, the redhead, the lesser scaup, the shoveller, the blue-winged teal, the gadwall, and the ruddy duck, have been seriously depleted in numbers, and up to the beginning of the breeding season of 1932 were in some cases faced with a possibility of reduction in numbers almost to the vanishing point.

So serious did this condition appear that it was found necessary to reduce the hunting season of 1931-1932 to a single month, and later to restrict the bag limits on a number of the species most seriously threatened and to place two of them, the bufflehead and the ruddy duck, on the closed list. What effect this added protection has had will be evident from the number of the birds that visit the entire United States during the winter of 1932-1933.

The State of Louisiana is obviously doubly interested in the preservation of the wild fowl that enter its borders during the winter season as well as those that here pass the summer.

It is, therefore, desirable that the citizens of this State be informed regarding the actual conditions not only in Louisiana but in the entire country, as this will naturally lead to the continuation of proper methods for the protection of these birds. Elsewhere in the United States, as well as in Louisiana, the establishment of sanctuaries on breeding areas on resting and on feeding areas is one of the most important means of aiding the birds. Likewise the proper protection of the waterfowl and as far as possible the restriction of actual drainage will do much toward preserving the supply of birds that ultimately find their way into the marshes of Louisiana.

It is important, however, that, in addition to this protection on the breeding and feeding grounds in the North, the wintering grounds be adequately cared for, since winter conditions, particularly those that pertain to the proper supply of food, are absolutely essential to the welfare of the waterfowl that visit the South. In fact, feeding grounds that the birds require in the winter are almost as essential as proper conditions on the breeding grounds; and in relation to this particular problem the State of Louisiana is an unusually important factor on account of the valuable character and great extent of the areas in this State suitable for waterfowl resorts.

Furthermore, sportsmen in Louisiana, by careful observance of the laws, can greatly assist the State Department of Conservation in its efforts to preserve the waterfowl. In fact, the sportsmen, in so doing are acting in their own interest, since laws and regulations instituted for the welfare of game birds are likewise for the benefit of all those interested in hunting.

Office Personnel of the Forestry Division

Division of Forestry Annual Report for the Year 1932

By V. H. SONDEREGGER,
State Forester

THE general program of the Forestry Division for the year 1932 was rather a strenuous one to supervise. The fire hazard was increased materially through many adverse conditions.

The fall of 1931 was very mild, without any cold weather, and both young trees and vegetation continued to grow during this period. With the warm winter carried on into January and February of 1932, a frost first appeared in the early part of March. This, of course, was very destructive not only to the young trees in the forest, but also to the ornamentals in the many homes and public sites of the State.

A continuous freeze for a week during March killed all of the vegetation. The temperature changed suddenly after the freeze and clear weather took place. A bright sun and a high wind rapidly dried out all of the frost-bitten vegetation of the forested areas, creating a highly inflammable condition.

The most serious forest fire problem took place on a Sunday, and for a week the Forestry Division's employees were fighting fires night and day and were able to hold the loss down to a small per cent. The cause of these fires has been attributed to several factors.

The large percentage of unemployment caused by the curtailment of lumber operations has to a large extent exposed the forested areas, to carelessness from transients, causing many of the fires. This hazardous condition continued until the new vegetation and rains set in about the middle of April. Since then the Forestry Division's employees have been able to combat the forest fire evil and the records incorporated in this report show that they reduced the fires 8,855 acres over the year 1931.

All employees of the Forestry Division must be given due credit for their alertness and their energy in handling the forest fire situation, and it is to their credit that the results show improvement over the previous year, which has been considered very favorable and has a low record in the Southern states for the large area protected.

Adjacent to the protection units, a greater part of the state materially benefited by the propaganda and assistance of the Forestry Division's employees. A general summary shows that at least ten million acres, of which the protection unit work contains 5,200,000 acres, and the balance of adjacent to protection units, as well as in the hardwood bottoms, did not suffer from many fires. The balance of the acreage of the State, approximately 9,200,000 acres, suffered from carelessness and incendiary fires from a 5 per cent loss to as high as a 60 per cent loss.

Mr. H. C. Thompson, St. Tammany Parish, Louisiana, and one of his five-year-old planted longleaf pine seedlings.

The greatest percentage of forest fire loss occurred in the West Louisiana longleaf pine belt, an area that has only a few trees, and, in the majority, a large acreage of cut-over lands that are mainly producing grass of the sedge type variety.

FOREST FIRE PROTECTION

The Division of Forestry's major efforts are the protection of the forests in the State of Louisiana, including the intensive co-operative protection work in which the landowners and Federal Government participate.

The year 1932 was one of extremes. During the early part of the season, particularly in March, a serious drought hazard took place for a week and caused an unprecedented number of fires of large size. These were incendiary and were set in isolated spots, causing the organization's employees difficulty in getting to the fires. The other extreme was in the latter part of the year when the ground was continuously wet from the middle of November to the 1st of January, only a small amount of forest fires being reported.

The organization, as a whole, responded effectively to all fires and maintained its usual efficiency throughout the year, overcoming the many adverse conditions existing.

Herewith reproduced is the annual fire report for the year 1932, showing the general details as to the size of the fires, the number of fires, and the causes.

CO-OPERATION

The funds for the maintenance of the Forestry Division are derived from sources that are not subject to tax assessments of the general public.

The State of Louisiana, through the Legislature, appropriates to the Division of Forestry $80,000.00 per year. This appropriation has been made payable for the season 1932 and 1933.

The United States Forest Service allotted to the State of Louisiana, from July 1, 1931 to July 1, 1932, the sum of $50,400.00. Congress, in curtailing the appropriation for the period from July 1, 1932 to July 1, 1933, allotted to the State of Louisiana $45,421.00.

On July 1, 1932, the United States Forest Service had an unexpended balance of state appropriation which was allotted to the states that were establishing a fire prevention system and for which extra funds were being spent. In accordance, an extra appropriation of $1,410.00 was allotted to the Louisiana Department of Conservation for its Forestry Division. On January 1, 1933, there were one hundred and ninety-three landowners in the State of Louisiana with 1,325,994 acres, paying $26,270.00.

The State appropriation is obtained from the severance tax of the forest products material, and this tax is paid at the time the timber is cut. Consequently, the work of the Forestry Division is not a direct taxation on any individual or groups, but is maintained by appropriations and all of these funds are spent in rebuilding and developing the forest products industry for not only the present but the future, with the plan of making this industry a continuous and permanent benefit to the State.

A view of a longleaf pine plantation. Planted four years ago with one-year-old longleaf pine seedlings. (Note height growth.)

EDUCATIONAL WORK

The Department of Conservation, through its Forestry Division, has established an Educational Section with a member who visits the schools and develops the idea of forest fire protection, as well as the growing of timber crops not only in the large areas, but also on the farms and small plots of land throughout the State. In addition, the Extension Department of the Louisiana State University co-operates with the Forestry Division and county agent and they have been of material assistance in this phase of the work.

It is interesting to note the activities of one outstanding county agent; namely, O. G. Price, who is in charge of the county agricultural work in St. Tammany Parish. Mr. Price has achieved a unique distinction during the year 1932 in having donated by a Mr. H. C. Thompson to his 4-H Club work a tract of four hundred and seventy-five acres of second growth longleaf and slash pines. Mr. Thompson became interested in reforestation several years ago and experimented with tree growth and developed an ideal second growth timber project. Realizing that education is the basic factor in reforestation problems, Mr. Thompson donated the entire tract to the 4-H Club members of St. Tammany Parish, of which Mr. O. G. Price is in charge. This act and project is a particularly worthy achievement and both Messrs. Thompson and Price are to be congratulated for their interest and activities in the development of forest resources on lands that had very little possibilities of agricultural development.

The work of farm forestry was somewhat retarded, due to the death of Mr. G. C. Boswell, who had started a very active program in Western Louisiana, particularly in Sabine and portions of De Soto Parishes. This work was taken over by Mr. V. L. Brumfield, who at present is in charge of the educational work under the direction of the State Forester.

It is the purpose of the Division of Forestry, as fast as its funds and personnel will permit, to develop farm forestry projects through educational work in farm regions where the forests have been diminished and practically been exhausted.

The Division of Forestry's personnel co-operates with the schools, and lectures to the students on the many phases of tree growth, as well as the protection of all natural resources.

Pine Tree Nursery of Great Southern Lumber Co., Bogalusa, La. Season 1928-1929—Seeds planted in March 1928 and transplanted to woods in December, 1928 and January, 1929.

TABLE NO. 1

SUMMARY OF REPORTED FIRES FOR PROTECTED AREAS IN LOUISIANA

January 1-December 31, 1931

Protection Area	Area Protected (Acres)	Number of Fires	Area Burned (Acres)	Per Cent Burned	Average Size of Fire	Damage Timber	Damage Other	Damage Total	Suppression Hours of Fighting	Suppression Estimated Cost
Morehouse	149,760	71	2,638	1.7	37.1	$ 2,629	$ 223	$ 2,852	623	$ 177
Union	350,000	426	9,921	2.8	23.3	9,915	885	10,800	2,786	811
North Louisiana	2,200,000	1,044	53,045	2.4	50.8	52,570	5,240	57,810	14,412	3,463
Bienville-Jackson	800,000	434	20,301	2.5	47.0	21,468	1,991	23,459	6,269	1,824
Sabine	370,000	190	5,786	1.6	30.5	5,732	568	6,300	1,603	393
Vernon	80,000	129	3,758	4.7	29.1	3,728	358	4,086	1,525	444
Beauregard-Calcasieu	75,000	3	5	.0	1.7	3	....	3	2	....
Allen	154,580	200	13,348	8.6	66.7	13,337	1,301	14,638	2,664	782
Livingston-St. Helena and Tangipahoa	690,000	362	19,917	2.9	55.0	20,054	1,926	21,980	3,704	895
Washington-St. Tammany	600,000	252	10,367	1.7	41.1	10,667	951	11,618	2,366	560
St. Tammany	110,000	130	5,685	5.2	43.7	5,641	558	6,199	705	158
St. Landry	11,000	....	....	....	.....	....	....	....	....	....
State Forest	7,500	....	....	....	.....	....	....	....	....	....
TOTALS	5,597,840	3,241	144,771	2.6	44.7	$145,744	$14,001	$159,745	36,659	$9,507

479,000 Acres added July 1, 1931.

TABLE NO. 2

HOW FIRES WERE DISCOVERED

January 1-December 31, 1931

Discovered By	Number of Fires	Per Cent by Number	Area Burned (Acres)	Average Size of Fire (Acres)
Employee in Charge	1,108	34.2	48,977	44.2
Towerman	1,774	54.7	82,072	46.3
Other State Employee	152	4.7	5,772	38.0
Volunteer	207	6.4	7,950	33.6
TOTALS	3,241	100.0	144,771	44.7

TABLE NO. 3

HOW FIRES WERE EXTINGUISHED

January 1-December 31, 1931

How Extinguished	Number of Fires	Per Cent by Number	Area Burned (Acres)	Average Size of Fire (Acres)
State Organization	3,039	93.8	139,475	45.9
Volunteer	92	2.9	1,622	17.6
Rained Out	14	.4	304	21.7
Burned Out	96	2.9	3,370	35.1
TOTALS	3,241	100.0	144,771	44.7

TABLE NO. 4

CLASSIFICATION BY SIZE

January 1-December 31, 1931

Size of Fire	Number of Fires	Per Cent by Number	Area Burned (Acres)	Suppression Hours of Fighting	Suppression Estimated Cost
0—1/4 Acres	81	2.5	....	75	$ 18
1/4—10 Acres	1,347	41.6	6,125	5,001	1,493
10—100 Acres	1,505	46.4	59,066	17,724	4,582
100—500 Acres	268	8.3	50,953	9,350	2,383
500—Over Acres	40	1.2	28,627	3,909	1,031
TOTALS	3,241	100.0	144,771	36,659	$9,507

TABLE NO. 6

STUDY OF FIRES BY TIME OF DAY

January 1-December 31, 1931

A. M. FIRES Time	Number of fires	Area Burned (Acres)	Average Size of Fire (Acres)	P. M. FIRES Time	Number of fires	Area Burned (Acres)	Average Size of Fire (Acres)
1:00	7	331	47.3	1:00	709	35,716	50.4
2:00	4	535	133.7	2:00	478	18,290	38.3
3:00	8	171	21.4	3:00	400	12,725	31.8
4:00	5	100	20.0	4:00	249	6,621	26.6
5:00	4	375	93.8	5:00	105	3,146	30.0
6:00	14	506	36.1	6:00	78	2,112	27.1
7:00	14	489	35.0	7:00	59	1,730	29.3
8:00	53	2,292	43.2	8:00	35	893	25.5
9:00	103	4,608	44.7	9:00	13	462	35.5
10:00	232	17,012	73.3	10:00	10	327	32.7
11:00	272	15,254	56.1	11:00	6	393	65.5
12:00	252	15,526	61.6	12:00	20	1,007	50.3
TOTALS	968	57,199	59.1	TOTALS	2.162	83,422	38.6

	Number of Fires	Area Burned (Acres)
A. M. FIRES	968	57,199
P. M. FIRES	2,162	83,422
ORIGIN HOUR NOT GIVEN	111	4,150
TOTALS	3,241	144,771

TABLE NO. 5

CLASSIFICATION BY CAUSES

January 1-December 31, 1931

Cause of Fire	Number of Fires	Per Cent by Number	Area Burned (Acres)	Damage Timber	Damage Other	Damage Total	Suppression Hours of Fighting	Suppression Estimated Cost
Lightning	19	.6	1,870	$ 1,878	$ 185	$ 2,063	337	$ 84
Railroads	73	2.3	1,360	1,345	149	1,494	713	181
Campers	82	2.5	1,437	1,425	132	1,557	639	163
Smokers	314	9.7	12,442	12,683	1,223	13,906	3,728	963
Brush Burning	191	5.9	6,742	7,197	692	7,889	1,599	433
Incendiary	1,812	55.9	91,903	92,018	8,927	100,945	20,761	5,466
Logging	131	4.1	4,145	4,198	375	4,573	1,578	308
Miscellaneous	612	18.8	24,724	24,852	2,304	27,156	7,256	1,896
Unknown	7	.2	148	148	14	162	48	13
TOTALS	3,241	100.0	144,771	$145,744	$14,001	$159,745	36,659	$9,507

TABLE NO. 7

STUDY OF FIRES BY MONTHS IN YEAR

January 1-December 31, 1931

Month	Number of Fires	Per Cent by Month	Area Burned (Acres)	Average Size of Fire (Acres)
January	266	8.2	8,241	39.8
February	528	16.3	29,484	55.8
March	738	22.8	34,305	46.5
April	315	9.7	10,551	33.5
May	55	1.7	1,118	20.3
June	93	2.9	3,539	38.1
July	118	3.6	5,144	43.6
August	87	2.7	2,604	30.0
September	270	8.3	14,089	52.2
October	392	12.1	18,577	47.4
November	362	11.2	16,014	44.2
December	17	.5	1,105	65.0
TOTALS	3,241	100.0	144,771	44.7

TABLE NO. 8

FOREST TYPE

January 1-December 31, 1931

Forest Type	Number of Fires	Per Cent by Number	Area Burned (Acres)	Per Cent by Area	Average Size of Fire (Acres)
Longleaf Pine	921	28.4	49,476	34.2	53.7
Shortleaf Pine	1.365	42.1	48,683	33.6	35.7
Mixed Pine	337	10.4	19,565	13.5	57.5
Mixed Pine and Hardwoods	589	18.2	26,589	18.4	45.1
Hardwoods	29	.9	458	.3	15.8
TOTALS	3,241	100.0	144,771	100.0	44.7

RESEARCH AND EXPERIMENTAL WORK

The Division of Forestry has a very advantageous position in research and experimental work.

The United States Forest Service's Southern Forest Experiment Station is located at New Orleans and gives the State Forester close contact with the Director and its personnel interested in the various activities of forest growth.

During 1932, co-operative programs were devised as to how to best obtain the necessary information on forest facts. The Experiment Station and the State Forester co-operated with the Forest Service in revising the report, which was submitted under the title of the "Extensive Revision of the Capper Report." In this work, the statistics and factors of Louisiana Forestry were brought up to date, and for the first time in the history of the work, results are very accurate and contain valuable information.

During the spring months, eight hundred acres of eight year old pine plantations were burned over by fire. Both the State and the Experiment Station have inaugurated check plots on this burned area to determine what damage has taken place, and what the future results will be. Definite figures have not been compiled for publication, but the results, so far, are very interesting and are very important as factors in the development of timber growth.

At the State Forest, the Division of Forestry is fortunate in having the co-operation of the pathologists in eliminating many of the diseases that occur in tree nurseries.

In addition, the United States Plant Bureau and the Division of Forestry have experimented on the introduction of new species of chestnut from the Orient. These experiments have proven very satisfactory for the short time they have been carried on, and there is no question that these chestnut trees will be of material assistance in rehabilitating not only the Gulf state areas of cut-over lands, but also in rebuilding the chestnut forests in the East which have been doomed by the chestnut blight.

The Southern Forest Experiment Station and the District Forest Inspector are co-operating with the State Forester's office in carrying on certain experiments to determine the amount of damage from forest fires. Very little definite information of this kind is on hand, and the State of Louisiana particularly realizes the fact that with the large areas of new timber growing, that this information is imperative and important, and the three agencies mentioned, in 1933, are going to carry on projects to determine the amount of damage actually incurred with each and every forest fire that burns over the lands.

Research work has been delayed materially on account of the general depressed condition of the industrial world. A great deal of this work is dependent upon the areas of the lumber companies where timber is being cut and, until the industry regains normalcy, it is doubtful if definite projects can be carried through for the coming year.

The Division of Forestry has been co-operating with the Audubon Park in the City of New Orleans to build up an arboretum. Splendid cooperation has been received from the Audubon Park Commission and many new species have been introduced not only from the State of Louisiana, but from neighboring states and foreign regions. The tree experiments in Audubon Park are of material assistance to the Division of Forestry, particularly in the hardwoods. Very little is known of the hardwood rate growth and the reproduction of hardwoods. An arboretum at Audubon Park will give material assistance to this project. In addition, the New Orleans Country Club is co-operating with the Division of Forestry and has planted approximately ten thousand species of native Louisiana hardwoods. These trees are all showing a good growth and furnishing tentative information that will be of value later on as the trees mature.

The City of Alexandria, in its park system, is also co-operating with the Division of Forestry, and many trees have been furnished this community.

Tree Planting

The year 1932 was one of the most active tree planting years in the history of the Department. The George Washington Bi-Centennial celebration took place and part of the program was tree planting.

The American Legion Posts at New Orleans were authorized by the Louisiana Highway Commission to take over the highway planting throughout the State. Three hundred and sixty-four miles of trees were planted by this organization alone.

All of the schools of the State, boy and girl scouts, and civic organizations participated in tree planting; the greater portion of them in commemmoration of George Washington's Bi-Centennial, and the balance continued the program in accordance with the weather conditions.

The State's tree nursery shipped 1,000,000 tree seedlings, which were planted by all agencies in the cities, towns, farms, and forest lands. In addition to the Forestry Division's efforts, cooperative forest landowners raised and planted 1,350,000 tree seedlings on their own lands. The total trees raised and planted in Louisiana by all agencies amounted to 2,350,000.

ANNUAL REPORT MINERALS DIVISION

(Continued from Page 12)

No. 22, and may be obtained for mailing charges only. To those interested in Louisiana Geology this reference is invaluable.

Since Mr. Dunbar's resignation the work has been carried on creditably by Mr. Albert D. Miller who became associated with the department the latter part of the year. Mr. Miller has spent much of his time carrying out the work started by Mr. Dunbar, in building up a reference Library for the Department, dealing with the Geology and Paleontology of Louisiana. His activities have also included considerable general laboratory work, viz: salt water determinations, gasoline, kerosene, tractor fuels and distillates for the Supervisor of Public Accounts.

Much time has also been spent in the field for the purpose of making core determinations for the operators, and at the same time gathering valuable information for the department files and records. This service was especially valuable in the new Converse area and was very favorably commented upon by those endeavoring to open up new sources of supply, and had it not been for this service no doubt much probable productive sand would have been passed up.

CONSERVATION OF RESOURCES

(Continued from Page 4)

Perhaps the most rational method of utilizing Lignite would be to produce the gas at the mines, crack the tar into motor fuel, convert the carbon also into Producer gas and sell a blend of the gases produced by piping it to large cities or centers of industry for consumption. This gas could be produced at a cost to the consumer not in excess of the natural gas rates at present for equal calorific value.

It is suggested that an increase in the fuel value of this gas might be accomplished at the gas works by converting the low b.t. in gas into a smaller volume of methane of 1000 b.t.u's cubic foot, which is nearly twice the standard of manufactured gas and about the same as natural gas.

As a by-product in this conversion, large quantities of carbon dioxide would be available which could be converted into liquid or into "Dry Ice" to be used for refrigeration or manufactured into synthetic methanol by calalytic action. Thus, the plant at the mine would become a nucleus for a chemical industry of great possibilities.

The rate of our economic progress is primarily a function of the abundance and cost of energy.

The preparation and use of fuels, and generation and distribution of energy, are basic industrial activities which in one way or another vitally concern us all.

Lignite carbon has practically the same high heat value as anthracite coal and no doubt will come to be recognized as a high grade fuel at some future time.

A colloidal form of lignite which remains indefinitely suspended in water has recently been put upon the market as a water soluble woodstain. When in proper concentration, it is applied to new wood, the wood is stained a deep brown color which is permanent to sunshine.

In the commercial form, some water soluble aniline colors are added to the dry colloidal powder, with the result that pleasing decorative effects are obtainable for wood staining and shading in a dozen or more tints.

To the thoughtful person it is obvious that, with increasing population and with diminishing supplies of many raw materials, something must be done to improve our industrial methods to secure higher efficiency and insure enduring supplies.

In such problems, chemistry will surely prove to be the most efficient agency for attaining the best economic results by turning wastes to profitable account, by finding higher uses for low grade products, and by finding substitutes for vanishing supplies.

The Contribution of Louisiana State University to the Development of Louisiana Geology [*]

By HENRY V. HOWE, Ph. D.,
Director, School of Geology, Louisiana State University
and
CYRIL K. MORESI, M. S.,
Geologist, Department of Conservation

WHILE observations had been made on the topography, climate, fossils, and mineral resources of Louisiana by numerous persons in the latter part of the eighteenth century and the first half of the nineteenth century, it was not until a chair of geology was created at the Louisiana State Seminary of Learning that any organized attempt was made by the State to determine what it contained in the way of mineral resources.

The study of geology was one of the first subjects to interest the leaders of higher education in Louisiana. When Louisiana State University opened its doors at Pineville on January 2, 1860, under the name "Louisiana State Seminary of Learning," Francis W. Smith occupied the chair of Chemistry, Geology, Mineralogy, and Infantry Tactics.[1] Since that date, the University has sponsored whatever geological research has been undertaken by the State, whether under the name of "Louisiana Geological Survey," or "Louisiana Soil and Geological Survey," or in cooperation with the Department of Conservation.

1865 TO 1878

Following the Civil War academic work was resumed at the Seminary on October 2, 1865, under the Presidency of David F. Boyd.[2] President Boyd was particularly interested in geology and personally made many collections of rocks and fossils. In the reorganization of the faculty Edward Cunningham[3] was appointed to the Chair of Chemistry, Mineralogy, and Geology. Professor Cunningham having entered into previous engagements elsewhere at the time of his appointment, arrangements were made for him to assume his duties in September, 1866. It appears that these duties prevented his return at that time for the next Report[4] shows John R. Page as Professor of Chemistry, Mineralogy, and Geology. Page entered into this work with enthusiasm and the Report records that he spent the summer of 1866 making collections of fossils and minerals for the Department.[5] Dr. Page resigned the following year on account of ill health.[6]

In January 1867, Judge J. B. Robertson presented to a committee of the Legislature a report entitled, "Memorial and Explorations of the Hon. J. B. Robertson in Relation to the Agricultural, Mineral, and Manufacturing Resources of the State." This report had been made under the authorization of Governor H. W. Allen and at the request of Governor J. M. Wells. Robertson stated in his report (p. 5) that, "when he (H. W. Allen) was called upon to assume the ofifce of Governor, he immediately authorized me to begin a systematic investigation of the agricultural, mineral, and manufacturing resources of Louisiana. Under Governor Allen's order I took with me Mr. Charles Tripp, a competent mineralogist and metallurgist, Mr. John H. Jones, a skillful iron-master of thirty-five years practical experience, and Captain John Roy, of New Orleans, a most intelligent and practical mechanist and artisan, and explored various portions of the State in search of iron and other minerals," and on page twelve he states, "No geological survey of Louisiana has ever been ordered by the State, and no complete report has ever been made. The partial reports of Professors Forshey, Thomssy (Thomassy) and others, form the only reliable data upon which we have heretofore been able to base any estimate of the mineral resources of the State. This estimate was exceedingly low, for in all cyclopedias, geographical and descriptive works, Louisiana is rarely recognized as having any claim to minerals. . . ."

He concluded his report by recommending that the Legisture establish a Bureau of Arts, Agriculture and Immigration, under the control of one Commissioner. He also suggested that among the duties of this Bureau, "It should search out and develope mines and minerals, and should under proper instructions, have control and supervision of all the mineral lands of the State."

His thirty page report was published by the

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[*] The authors wish to thank Professor J. A. McMillen, Librarian, La. St. Univ.; Miss Louise Lowe, Librarian, School of Geology; and Mr. T. J. Johnson for the assistance which they have cheerfully given us in the preparation of this article.

[1] La. St. Univ., Rp. St. Seminary Learning, Jan. 1860, (Baton Rouge 1860) p. 12.

[2] Ibid., 1866, (covers year 1865), p. 4.

[3] Ibid., p. 4.

[4] Ibid., 1867, (covers year 1866), p. 16.

[5] Ibid., p. 8.

[6] La. St. Univ., Ann. Rp. La. St. Seminary Learning, 1867, (New Orleans, 1868), p. 8.

State printer in New Orleans in 1868. It was apparently well received by the Legislature and the people of the State and aroused considerable interest in the natural resources of Louisiana.

On March 4, 1867, Colonel S. H. Lockett assumed his duties as professor of Engineering and Commandant of Cadets at the Louisiana State Seminary of Learning, and the following September (1868), Dr. H. V. Hopkins occupied the Chair formerly held by Dr. Page. The Annual Report[7] covering this year records that many valuable specimens of minerals and fossils were added to the school's collections. The addition of Hopkins and Lockett to the staff of the Seminary furnished the necessary impetus for the initiation of a Topographical and Geological Survey. These young men entered vigorously into the study of the natural resources of the State and added greatly to the Seminary's collections. They were given every encouragement by President Boyd who addressed the following to the Legislature in their behalf:[8]

> "Last year I addressed the accompanying printed circular, (M) to many of the leading citizens of the State, with the view of obtaining valuable information of a scientific character, from all parts of the State. Several persons have responded to the call, and others will, no doubt, do likewise during the coming year; but the seminary, if it had the means, should undertake a thorough *Topographical and Geological Survey of Louisiana.* With a little aid from the State it could be accomplished after this manner:
>
> "Let the Legislature make it obligatory on the seminary to make such surveys by requiring its Professor of Engineering and Professor of Chemistry, etc., to spend at least four months of every year in the field, till the work is satisfactorily finished; and for this *extra* service, let each of those Professors be paid one thousand dollars, and for travelling expenses and other incidentals, each, five hundred dollars. Col. S. H. Lockett, the Professor of Engineering, and Dr. H. V. Hopkins, the Professor of Chemistry, etc., are well qualified to enter upon so important a work, being thoroughly scientific, young and active, and full of zeal for the undertaking."

The Official Register[9] for the ensuing session carries the announcement of the Topographical and Geological Survey of Louisiana as follows:

> "Recently by Act of the Legislature, the Professors of Engineering, Chemistry, Mineralogy and Geology of the Institution are required to make jointly, a Topographical and Geological Survey of Louisiana. To this duty they devote not less than four months of every year; thus securing to the young Louisianan unusual facilities for learning the physical features of his State and of the whole Southwest."

The following session Professor Americus Featherman was appointed to the Chair of Modern Languages.[10] Featherman began his duties on September 1, 1869, and becoming interested in the work of Hopkins and Lockett, he undertook a botanical survey of the State.

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[7] Ibid., Ann. Rp., 1869, p. 23.

[8] Ibid., p. 26.

[9] La. St. Univ., Official Register, La. St. Seminary Learning, (New Orleans, 1869), p. 21.

[10] Ibid., Ann. Rp. 1870, p. 29.

New Geology School Building Louisiana State University

In May and June of 1869, Dr. Eugene W. Hilgard, State Geologist of Mississippi, made a geological reconnaissance of Louisiana spending 28 days on horseback and covering about 625 miles. The results of this reconnaissance were incorporated into a number of subsequent papers.[11]. It also permitted Hilgard to prepare the first geological map of Louisiana which was presented before the Chicago meeting of the American Association for the Advancement of Science. The Topographical and Geological Survey of the State having been begun by Professors Hopkins and Lockett almost simultaneously with Hilgard's reconnaissance, provided much necessary information for Hilgard's map. The revised map was first published by Hopkins.[12]

The Louisiana State Seminary of Learning was destroyed by fire on October 15, 1869. Fortunately the Library and Geological collections were but little damaged and were later moved to Baton Rouge. The name of the Seminary was changed to Louisiana State University, and the Institution domiciled in the School for the Deaf, at which location it remained until 1886. The fire and change in the site of the University did not seriously interrupt the survey being made by Hopkins and Lockett and the years 1870 to 1872 saw the publication of the three Annual Reports of Hopkins' Geological Survey of Louisiana.[13] These years also saw the First, Second, and Third Annual Reports of Featherman's Botanical Survey of Louisiana,[14] and the First, Second, and Third Annual Reports of Lockett's Topographical Survey of Louisiana.[15] Lockett resigned from Louisiana State University in June 1873 after completing his Fourth Annual Survey which was accompanied by a large topographical map. The expense of printing this report prevented its immediate publication. President Boyd recommended to the Legislature that an appropriation be made to publish the large topographical map of Louisiana.[16] The text of the Fourth Annual Report was published by the University several years later.[17] Lockett's map probably was published several times but is nevertheless rare at the present time. The Library of the Louisiana State University contains a copy of this map printed by the famous map engravers G. W. & C. B. Colton & Co., New York, under the date of 1873.

While Hopkins, Featherman, and Lockett were making their surveys of Louisiana, the University made a number of large additions to its geological and paleontological collections. The Official Register of Louisiana State University for the session 1871-72, (page 37) presents the following summary of these additions:

> "There is an immense collection of minerals, and geological and conchological specimens, many thousands in number, and a rich Herbarium, all scientifically determined and well arranged.
>
> "In fact, no institution in the South is superior to the University in regard to cabinets of that nature. The extensive collections of the *late* Col. Wailes, of Mississippi Dr. J. B. Hall, of New Orleans, and Dr. R. D. Nevius of Mobile, have been secured, and large accessions are constantly being made through the labors of the Professors engaged upon the Topographical, Geological and Botanical Surveys of the Sate, by the donations of public-spirited citizens, and by purchase.
>
> "Recently the Ames Museum (in New Orleans) of Natural History and Curiosities was obtained, by means of which, together with the large number of specimens of animals, birds, reptiles, insects, etc., previously on hand, and the many other easily to be procured in the South-West, the University hopes soon to have a very large and scientifically valuable Museum of Natural History.
>
> "An immense number of Indian relics, of almost every description, and some old coin, make up about all the University has of Archaeology."

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[11] "Preliminary report . . . of a geological reconnaissance of Louisiana," De Bow's New Orleans Monthly Review, V. 37-38, pp. 754-769 (1869).

"Summary of results of a late geological reconnaissance of Louisiana," Am. Jour. Sci., Second Series, V. 48, pp. 331-346 (1869).

"Supplementary and final report of a geological reconnaissance of Louisiana . . . " 44 pp., New Orleans, 1873.

[12] "Second annual report of the geological survey of Louisiana," La. St. Univ., Ann. Rp. 1871 (New Orleans, 1871), 35 pp., map.

[13] "First Annual report of the Louisiana State Geological Survey," La. St. Univ. (St. Seminary of Learning), Ann. Rp. 1869 (1870), pp. 77-109.

"Second annual report of the geological survey of Louisiana," La. St. Univ., Ann. Rp. 1870 (New Orleans, 1871), 35 pp., map.

"Third annual report of the geological survey of Louisiana," La. St. Univ., Ann. Rp. 1871, pp. 163-206, map, (1872).

[14] "First report of botany of Louisiana," La. St. Univ. (St. Seminary of Learning), Ann. Rp. 1869 (New Orleans, 1870), p. 111-114.

"Report of botanical survey of southern and central Louisiana," La. St. Univ., Ann. Rp. 1870 (New Orleans, 1871), 75 pp.

"Third annual report of botanical survey of southwest and northwest Louisiana," La. St. Univ., Ann. Rp. 1871 (New Orleans, 1872), pp. 101-161.

[15] "Topographical survey of part of Louisiana," La. St. Univ. (St. Seminary of Learning), Ann. Rp. 1869, (New Orleans 1870), pp. 49.

"Second annual report of the topographical survey of Louisiana," La. St. Univ., Ann. Rp. 1870, (New Orleans, 1871), 35 pp.

"Third annual report of the topographical survey of Louisiana," La. St. Univ., Ann. Rp. 1871, (New Orleans 1872), 14 pp.

[16] La. St. Univ., Ann. Rp. 1874, (New Orleans 1874), p. 27.

[17] "Fourth annual report of topographiacl survey of Louisiana," 1872, La. St. Univ., Ann. Rp. 1877-78, pp. 131-166.

The Topographical, Geological, and Botanical Surveys conducted by Lockett, Hopkins, and Featherman were initiated at the expense of the professors themselves but through the active agency of President Boyd the Legislature appropriated an aggregate sum of $19,000.00 to enable them to prosecute their work.[18] As additional funds were not appropriated these surveys were discontinued. Hopkins' name appears in the annual report of the University for the year 1874.[19] The next annual report[20] of the University to which the writers have had access is that for 1877-78; Hopkins' does not appear in that report.

In 1878, Colonel Lockett, then a member of the staff at the University of Tennessee, delivered the Commencement Address at the Louisiana State University which was entitled, "The Valley of the Nile and the Mississippi."[21] This address, printed in full in the University's Register, is an important document on the geography of the State which appears to have been completely overlooked by subsequent workers in that field.

1878 TO 1891

From the termination of the State Geological Survey, under Professor Hopkins, until Dr. Otto Lerch was employed by the State Experiment Station in 1891, geological investigation in Louisiana remained nearly stationary. The annual reports of the Louisiana State University covering this period contain but few references to geological instruction or investigation.

The Annual Report[22] for 1877-78 contains the following statements: "Among the principal studies that relate to agriculture, may be mentioned General Chemistry, Physics, Mineralogy, Geology, . . . etc.",[23] and "Degrees of Bachelor of Arts will be conferred on graduates in the following subjects: Geology, Mineralogy, Chemistry . . . etc."[24] The Official Register[25] of the University, however, presents a somewhat different picture. From it the following sentence is quoted: "The subject of Mineralogy is, for the time, attached to this department (Department of Chemistry)." Richard S. McCulloch was listed as Professor of Chemistry.

It appears that the University attempted to revive interest in the Survey of the State during the Session 1880-81. From the report of the Board of Supervisors we quote: "The Professors of Engineering, Chemistry, Mineralogy, and Geology of Louisiana State University shall be allowed $500.00 per annum for necessary travelling expenses while in performance of their duties making the topographical and geological surveys."[26] These surveys apparently resulted in no publications.

From an examination of the University catalogues we conclude that little if any work was given in Geology, from the time of Hopkins until the session of 1886-87. In that year Geology was included under the Department of Natural History and was taught by Professor S. M. Robertson. The catalogue states: "Geology is taught in the first term of the Senior Class. Special study of the geology of Louisiana is made: LeCompte's [*sic*] geology is used as a text. The Library contains many good works of reference, which are accessible to the class for use."[27]

Mineralogy was given under the Department of Chemistry, with B. B. Ross as professor. The catalogue states: "All students are required to take a course in Mineralogy during the last half of the Senior year. The course embraces instruction in theoretical and determinative mineralogy. The mineralogical cabinets are very comprehensive, containing, as they do, collections added from year to year, as well as valuable contributions from the New Orleans Exposition."[28]

Robertson was replaced the following year by Col. A. T. Prescott as Professor of Natural History (and Geology), a position which he held until the session of 1892-1893.[29] Professor Ross continued to teach Mineralogy until the start of the session of 1893-94.[30]

1891 TO 1898

This period is marked by the entrance of the Agricultural Experiment Station of the University into the field of Agricultural and Geological Surveys. From their Fourth Annual Report,[31] 1891, the following interesting paragraphs are quoted:

> "The Stations ever since their establishment have been laboring under the ignorance of the composition and classification of the soils of the State, and therefore could not

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[18] "General History of the Louisiana State University," 1806-88, (Baton Rouge 1899), p. 4.

[19] La. St. Univ., Ann. Rp. 1874 (New Orleans 1875), p. 27.

[20] Ibid., 1877-78.

[21] Lockett, S. H., "The Valley of the Nile and the Mississippi," La. St. Univ., Official Register, 1877-78, (New Orleans 1878), pp. 105-125.

[22] La. St. Univ., Ann. Rp. Session 1877-78.

[23] Ibid., p. 6.

[24] Ibid., p. 8.

[25] La. St. Univ., Official Register, Sessions 1877-78, (New Orleans 1878), p. 29.

[26] La. St. Univ., Ann. Rp. Session 1880-81, (Baton Rouge 1882), p. 43.

[27] Catalogue, La. St. Univ., 1886-87, (1887), p. 27.

[28] Ibid., p. 30.

[29] Ibid., 1887-88, p. 37; 1888-89, p. 25; 1889-90, p. 25; 1890-91, p. 27; 1891-92, p. 31.

[30] Ibid., 1886-87, p. 28; 1887-88, p. 40; 1888-89, p. 28; 1889-90, p. 23; 1890-91, p. 26; 1891-92, p. 29; 1892-93, p. 31.

[31] Fourth Ann. Rp., La. St. Exp. Sta., 1891, (Baton Rouge 1892), p. 19.

> positively reply to the many interrogations as to the adaptability of certain crops and fertilizers. No systematic examination of the soils of this State has been made. It has therefore been deemed expedient to essay an agricultural survey of this State, mapping carefully lands of similar origin and composition, and collecting typical soils of the State. The latter properly labelled, will be sent to the laboratories of the Stations and be carefully subjected to physical and chemical analyses. In the end all this work will be published with a carefully revised agricultural map of the State. Incidentally the geology of the State will also be studied and especial attention paid to the examination and collection of our fertilizing resources, such as phosphates, marls, gypsum, etc.
>
> "Dr. Otto Lerch, a graduate of a German University, and for several years engaged in the Texas Geological Survey, has been employed for the work and has already entered upon his duties. The soils as fast as collected, will be forwarded to the different laboratories, where they will be examined with all possible dispatch."

The first report by Lerch[32] appeared in 1892. His second report[33] appeared in the following year at which time Lerch appears to have severed his connections with the Experiment Station as did Professor A. T. Prescott, the station's Botanist.[34] Professor W. W. Clendenin who had been appointed to the Chair of Botany and Geology[35] in the University became the botanist and geologist for the Experiment Station.[36] At this point it is interesting to note that Clendenin upon his appointment completely rearranged the fossils and other materials in the museum and asked for an appropriation of $5000.00 for additional equipment.[37]

With the arrival of Clendenin, the geological work of the University was reassembled into a single department, though still combined with Botany under the departmental heading of Geology, Mineralogy, and Botany. Courses were offered by Clendenin in Meterology, Physical Geography, Elementary Geology, Economic Geology, General Critical Geology, Petrography, Determinative Mineralogy, and Optical Crystallography.[38] This marked the first attempt of the University to give advanced technical training in this field of science. Clendenin says of the University's equipment for this purpose:[39]

> "COLLECTIONS.—Our mineral collection consists of more than five thousand specimens, not including the large collection of ores brought from the New Orleans Exposition. This is now in condition to be used by the instructor for class demonstration.
>
> "The collection of fossils is almost equally large, though as yet somewhat disarranged. It is hoped, however, by October, 1894, this collection too will be entirely available for class use.
>
> "EQUIPMENT.—While not by any means what we desire, and hope to have, yet the equipment of the departments of Geology and Mineralogy are sufficient to carry on the work of the courses offered in these sciences. By the beginning of another year we hope materially to add to our apparatus and library, so that no man need hesitate to undertake the work of any course offered from the fear of insufficient facilities.
>
> "LABORATORIES. — Complete facilities are offered for the work of Determinative Mineralogy, and for the physical, chemical and optical determination of rocks. In addition to the apparatus now in this department, it is the intention, during this year, to add complete apparatus for the physical analysis of the soils."

Clendenin deserves a special word of commendation for his services to the University and to the State. To him goes the credit for reassembling and to a large extent relabelling the University's extensive Geological and Paleontological collections, which in the 20-year interval since the time of Hopkins, had been distributed among several departments. His duties not only called for his handling the entire work in Geology, Mineralogy, and Botany, but he was called on to take the place of Lerch in handling the Geological and Soil Survey of the State for the Experiment Station. This he did in a most able manner as his two reports to the director of the Experiment Station attest.

Clendenin's first report[40] appeared in 1896 and his second report[41] appeared in 1897. Professor Clendenin resigned from the University in 1898.[42] Before giving up geological work, however, Clendenin published a short paper on clays of Louisiana.[43]

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[32] "A preliminary report upon the hills of Louisiana, north of the Vicksburg, Shreveport and Pacific R. R.," La. St. Exp. Sta., Geol. Agr. La., pt. 1 (1892), pp. 1-15.

[33] "A preliminary report upon the hills of Louisiana, south of the Vicksburg, Shreveport and Pacific R. R. to Alexandria, La.," La. St. Exp. Sta., Geol. Agr. La., pt. 2 (1893), pp. 53-158.

[34] Sixth Ann. Rp., La. St. Exp. Sta., 1893, (Baton Rouge 1894), p. 4.

[35] La. St. Univ., Rp. Sessions 1892-93 and 1893-94, (Baton Rouge 1894), p. 32.

[36] Sixth Ann. Rp., La. St. Exp. Sta., 1893, (Baton Rouge 1894), p. 6.

[37] La. St. Univ., Rp. Sessions 1892-93 and 1893-94, (Baton Rouge 1894), p. 32.

[38] Catalogue, La. St. Univ., 1893-94, (1894). pp. 44-48.

[39] Ibid., p. 49.

[40] "A preliminary report upon the Florida parishes of east Louisiana and the bluff, prairie, and hill lands of southwest Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 3, pp. 159-247, (1896).

[41] "A preliminary report upon the bluff and Mississippi alluvial lands of Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 4, pp. 257-290, (1897).

[42] Eleventh Ann. Rp., La. St. Exp. St., 1898, (Baton Rouge 1899), p. 4.

1898 TO 1908

This is the period usually referred to as the Harris and Veatch surveys. W. C. Stubbs gives the following account of the establishment of this survey:[44]

> "Prof. W. W. Clendenin, who has been Field Geologist, has also resigned and returned to Missouri, where he has established a private school. His place has been filled by the employment of Prof. Gilbert D. Harris, of Cornell University, who has been placed in charge of the field work of the survey, and who gives three months of each year to this work. He is ably assisted by Mr. A. C. Veatch, who devotes his entire time to the survey. It is proposed by this survey to accurately map, geologically, agriculturally, and topographically, the townships of the State, and establish a North and South Line at each county seat of the different parishes; to collect soils, clays, shells (recent and fossil), plants (recent and fossil), fungii, etc. To establish the parting lines of the different formations and their difference in sylvae."

This survey was ably conducted by Professor Gilbert D. Harris for the succeeding ten years. It resulted in the publication by the survey of a number of exceedingly valuable reports which outlined the major geological features of the state with surprising accuracy.[45] In addition the men connected with the Survey published elsewhere a number of geological articles dealing with Louisiana Geology.[46] In fact it may well be said that this survey was largely responsible for the great development which has since taken place in the production of petroleum, natural gas, salt, limestone, and other mineral resources; a production which has had a total value of over a billion dol-

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[43] "Clays of Louisiana," Eng. Min. Jour., V. 66, (1898), pp. 456-457.

[44] Eleventh Ann. Rp. La. St. Exp. Sta., 1898, (Baton Rouge 1899), p. 4.

[45] Harris, G. D., and Veatch, A. C.

"A preliminary report on the geology on the Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 5, 354 pp. il, map, (1899).

Harris, G. D.

"The Natchitoches area," La. St. Exp. Sta., Geol. Agr. La., Sp. Rp. No. 1, pp. 140-148, map, pt. 5 (1899).

"The Cretaceous and lower Eocene faunas of Louisiana," La. St. Exp. Sta., Geol. Agr. La., Sp. Rp. No. 6, pp. 289-310, pt. 5 (1899).

"Establishment of Meridian Lines," La. St. Exp. Sta., Geol. Agr. La., Sp. Rp. No. 7, pp. 311-324, pt. 5 (1899).

"A few notes on road making," La. St. Exp. Sta., Geol. Agr. La., Sp. Rp. No. 8, pp. 325-330, pt. 5 (1899).

"The geology of the Mississippi embayment with special reference to the State of Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 6, Sp. Rp. No. 1, pp. 1-39, map, (1902).

"Subterranean waters of Louisiana," La. St. Exp. Sta. pt. 6, Sp. Rp. No. 6, pp. 195-252, (1902), (Harris, G. D., and J. Pacheco).

"Improvements in Louisiana cartography," La. St. Exp. Sta., Geol. Agr. La., pt. 6, Sp. Rp. No. 5, pp. 173-251, il, (1902).

"Oil in Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 6, Sp. Rp. No. 8, pp. 261-275, (1902).

"Underground waters of southern Louisiana," La. St. Exp. Sta., Geol. Surv. La., Bull. 1, pp. 1-77, map, (1905).

"Establishment of tide gage work in Louisiana," La. St. Exp. Sta., Geol. Surv. La., Bull. 3, pp. 221-248, il, (1905).

"Notes on the geology of the Winnfield sheet," La. Geol. Surv., Bull. 5, 36 pp., map, (1907).

"Cartography of southwestern Louisiana with special reference to the Jennings sheet," La. Geol. Surv., Bull. 6, 24 pp., map, (1907).

"Salt in Louisiana, with special reference to its geological occurrence," La. Geol. Surv., Bull. 7, pp. 5-59, map, (1908).

"Domes; or, structural peculiarities of the salt-bearing localities of Louisiana and southeast Texas," La. Geol. Surv., Bull. 7, pp. 59-83, (1908).

(assisted by Maury, C. J., and Reinecke, L.)

"Rock salt, its origin, geological occurrence, and economic importance in the State of Louisiana, together with brief notes and references to all known salt deposits and industries of the world," La. Geol. Surv., Bull. 7, 259 pp., maps, (1908).

(and Perrine, I., and Hopper, W. E.)

"Oil and gas in northwestern Louisiana with special reference to the Caddo field," La. Geol. Surv., Bull. 8, 52 pp., (1909).

Veatch, A. C.

"The Shreveport area," La. St. Exp. Sta., Geol. Agr. La., pt. 5, Sp. Rp. No. 2, pp. 149-262, map, (1899).

"The Five Islands," La. St. Exp. Sta., Geol. Agr. La., pt. 5, Sp. Rp. No. 3, pp. 208-262, maps, (1899).

"Salines of North Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 6, pp. 41-100, maps, (1902).

"The geography and geology of the Sabine River," La. St. Exp. Sta., Geol. Agr. La., pt. 6, Sp. Rp. No. 3, pp. 101-148, map, (1902).

"Notes on the geology along the Ouachita," La. St. Exp. Sta., Geol. Agr. La., pt. 6, Sp. Rp. No. 4, pp. 149-172, maps, (1902).

"Geology and underground water resources of northern Louisiana with notes on adjoining districts," La. St. Exp. Sta., La. Geol. Surv., Bull. 4, 210 pp., (1906).

"The underground waters of northern Louisiana and southern Arkansas," La. St. Exp. Sta., La. Geol. Surv., Bull. 1, pt. 2, pp. 82-91, map, (1905).

"A dictionary of altitudes in northern Louisiana," La. St. Exp. Sta., La. Geol. Surv., Bull. 1, pt. 2, pp. 93-164, (1905).

Ries, H.

"A report on Louisiana clay, samples," La. St. Exp. Sta., Geol. Agr. La., pt. 5, Sp. Rp. No. 4, pp. 261-271, il., (1899).

Hollick, Author.

"A report on a collection of fossil plants from northwestern Louisiana," La. St. Exp. Sta., Geol. Agr. La., pt. 5, Sp. Rp. No. 5, pp. 276-289, il., (1899).

Harris, R. A.

"The tides in the Rigolets," La. St. Exp. Sta., Geol. Agr. La., pt. 6, Sp. Rp. No. 7, pp. 253-260, (1902).

Bauer, L. A., and others.

"A report on terrestrial magnetism and meridian line work in Louisiana," La. Geol. Surv. Bull. 2, pp. 165-221, (1905 Report).

[46] Harris, G. D.

"Underground waters of southern Louisiana," U. S. Geol. Surv., W-S. P. 101, 98 pp., map, (1907).

"The salt domes of Louisiana and Texas," (abs.), Science N. S., V. 27, pp. 347-348, (1908).

"Note on the 'Lafayette beds' of Louisiana," Science N. S., V. 27, p. 351, (1908).

"The geological occurrence of rock salt in Louisiana and east Texas," Ec. Geol., V. 4, pp. 12-34, map, (1909).

"Oil and Gas in Louisiana with a brief summary of lars in the past 35 years. It also resulted in the establishment of a tidal gage station which permitted the accurate determination of sea level and from this were established precise bench-marks in practically all of the parishes of the State. The establishment of these bench-marks served as a primary control governing the accuracy of highway, levee, and land surveys throughout the State and has been a major factor in the development of the State's highway and flood control systems. Unfortunately the funds for this survey which were at all times meager were exhausted[47] with the publication of the 260 page volume on salt and the 52 page report on the Oil Fields of Caddo Parish.

Harris showed remarkable ability in the management of the small funds at his disposal. He spent half of his time each year in Louisiana conducting the survey; the remainder of the year being devoted to his teaching at Cornell University. Many of his assistants were students of his from Cornell. By conducting the survey in this manner he was able to utilize a portion of the available funds to obtain the cooperation of the United States Geological Survey, the United States Coast and Geodetic Survey, and the United States Department of Agriculture, Bureau of Soils. Each of these organizations placed parties in the field and the National Government contributed to their support a sum many times the $2500.00 which appears to have been the largest amount Harris had available in any one year to devote to their services. It was through this arrangement that the basic elevations in Louisiana were run, that many of the topographical quadrangles were made, and that the Bureau of Soils started its campaign of Parish Soil Surveys. The Bureau of Soils has continued the construction of soil maps of Louisiana Parishes to the present time.

The men connected with the Harris survey in the ten years of its existence were:

1898-1899. A. C. Veatch, Assistant to Harris.

1900-1901. J. Pacheco, Assistant to Harris.

1902. E. F. Lines, Assistant to Harris.
C. E. Smith, Assistant to Harris.
A. C. Veatch, detailed by the U. S. Geological Survey to cooperate in the study of underground waters of North Louisiana.
Edwin Smith, detailed by the U. S. Coast and Geodetic Survey to establish North and South lines at parish seats.
George N. Coffey and T. D. Rice, detailed by U. S. Department of Agriculture to make soil surveys.

1903. E. Reinecke, Assistant to Harris.
L. Smith, U. S. Coast and Geodetic Survey, studying magnetic variations.
T. D. Rice and Mr. Jones, Soil Surveys.
J. H. Renshawe and H. M. Wilson, U. S. Geological Survey making topographic maps.

1904. A. J. Pacheco, Assistant to Harris.
The Bureau of Soils and the U. S. Geological Survey both maintained their parties intact.

1905. J. L. Rich and F. L. Whitney, Assistant to Harris. The Bureau of Soils and the U. S. Geological Survey continued their parties in Louisiana.

1906-1907. F. L. Whitney, Assistant to Harris.
The Bureau of Soils and the U. S. Geological Survey continued their parties in Louisiana.

1908. I. Perrine and W. Hopper, Assistant to Harris.
Dr. Carlotta J. Maury, Laboratory Assistant to Harris in paleontology.
The U. S. Coast and Geodetic Survey detailed Mr. Hinton to work at the Louisiana Weeks Island Tide Gage Station.

In the year immediately following the resignation of Clendenin, instruction in Geology at Louisiana State University was greatly restricted. From the session 1897-1898 to the session 1901-1902 Geology was included in the write up of the courses in Agriculture as a single-semester in Ele-

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their occurrence in adjacent States," U. S. Geol. Surv., Bull. 429, 192 pp., (1910).
"The lower Tertiaries of Louisiana," Science N. S., V. 31, p. 502, (1910).
"Oil concentration about salt domes," Science N. S., V. 35, pp. 546-547, (1912).
"Dome theories as applied to Gulf Coast geology," Science N. S., V. 36, pp. 173-174, (1912).
"Immense salt concretions," Pop. Sc. Mo., V. 82, pp. 187-191, (1913).
"Age flow and ebb of the Eocene seas," Science N. S., V. 48, pp. 646-647, (1918).
Veatch, A. C.
"The question of the origin of the natural mounds of Louisiana, Arkansas, and Texas," (abst.), Science N. S., V. 21, pp. 310-311, 350-351, (1905).
"On the human origin of the small mounds of the lower Mississippi Valley and Texas," Science N. S., V. 23, pp. 34-36, (1906).
"Geology and underground water resources of northern Louisiana and southern Arkansas," U. S. Geol. Surv. P. P. 46, 422 pp., map, (1906).
Hopper, W. E.
"The Caddo oil and gas field, La.," Am. Inst. Min. Eng., Bull. 52, pp. 283-309, (1911); Trans. V. 42, pp. 409-435, (1912).

[47] Twenty-Second Ann. Rp., Agr. Exp. Sta., La. St. Univ., 1909, (1910), p. 28.

mentary Geology.[48] During these years, Dr. William C. Stubbs, William C. Dalrymple, and Frank H. Burnette comprised the faculty in Agriculture. The catalogues do not specify which of these men taught the course in Geology.

With the session of 1901-1902, Mr. A. C. Veatch, geologist for the "Harris" Survey, was added to the faculty as Professor of Geology. Veatch offered courses in General Geology, Meteorology, Physical Geography and Geology of Louisiana. An advanced course was also offered which permitted of field work on the State Survey.[49] This arrangement was terminated by the resignation of Mr. Veatch that year.

The following session Geology was again returned to the single-semester introductory course; taught this time by Professor H. A. Morgan, of the Department of Zoology.[50] This arrangement continued the following year.[51] The next year this single course is listed under the name of Prof. C. E. Coates, of the Department of Chemistry.[52] The following year, 1905-1906, the course is listed under the name of Professor G. D. Harris without other change in the write-up, and the catalogue carries the announcement that he had been elected to the faculty.[53] If Harris ever served on the instructional staff of the University, it was not for long, however, for the name does not appear on the faculty list the following year, and the single course in Geology is again listed under Professor Coates.[54] This course was taught by Professor Coates for the succeeding three years,[55] after which time geology ceased to be a subject of instruction at the University for a period of three years.

1913 TO 1922

The session 1913-1914 saw the addition to the faculty of Dr. Frederick E. Emerson as professor of Geology. Dr. Emerson again reassembled the geological collections which had become somewhat scattered since the time of Clendenin. Many of the museum labels were re-written by him as they were becoming illegible with age and he started a museum catalogue of the specimens. He was not permitted much time for this, however, as he offered courses in General Geology, Physiography, Agricultural Geology, Rocks and Minerals, Economic Geology, and a course in Geological and Geographic Field work—all of which had to be given in the first semester. The second semester was devoted to soil surveys for the State Experiment Station. Under this arrangement the Survey was recreated with the title, Louisiana Soil and Geological Survey.

The Louisiana Soil and Geological Survey issued no geological publications, but Dr. Emerson did publish three papers dealing with Louisiana geology elsewhere,[56] and during his residence at Louisiana State University he wrote a textbook on Agricultural Geology which is still a standard work on that subject.

Dr. Emerson died October 11, 1919, and from that time until the arrival of the senior author, July 1, 1922, the University was without the services of a geologist.

1922 TO PRESENT TIME

The appointment of Dr. H. V. Howe to the position in Geology on the faculty of Louisiana State University in 1922 marked a profound change in the academic policy of the University with respect to that subject. Dr. Howe was to give his full time to instruction and the University embarked on a policy of developing a professional school in Geology and Petroleum Engineering so that Louisiana boys might have the opportunity to fit themselves for positions in the petroleum business. The success of this policy was immediate and the Department of Geology entered upon a growth which has been rapid and continuous to the present time. To illustrate the thoroughness of the reorganization of the Geological Department we quote from the Biennial Report of the University for 1924:[57]

> "After a lapse of three years since the death of Dr. Emerson, the Department of Geology was re-established in 1922, by the appointment of Dr. H. V. Howe to the chair of Geology and Mineralogy. Dr. Howe devoted the summer of 1922 to straightening out the collections of the department. The task was a large one for these collections dated back to 1834 and included a wealth of material collected by the old State Geological Surveys under Clendenin, Lerch, Harris and Veatch. The difficulty of properly arranging the material was greatly enhanced by the fact that no one had ever taken the time to number and index the greater portion of the material and twenty

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[48] Catalogue, La. St. Univ., 1897-1898, p. 29; 1898-1899, p. 25; 1900, p. 25; 1901, p. 25.

[49] Ibid., 1902, p. 38.

[50] Ibid., 1903, p. 43.

[51] Ibid., 1904, p. 43.

[52] Ibid., 1904-5, p. 46.

[53] Ibid., 1906, p. 6.

[54] Ibid., 1907, p. 53.

[55] Ibid., 1908, p. 106; 1909, p. 144; 1910, p. 176.

[56] Emerson, F. V. "Occurrence of introformational conglomerate and breccia," (*abst.*) Geol. Soc. Amer., Bull. 27, 1916, p. 93.

"Loess-depositing winds in Louisiana," Jour. Geol. V. 26, 1918, pp. 532-541, (*abst.*), Geol. Soc. Amer., Bull. 29, 1918, p. 79.

"Some Port Hudson outcrops in Louisiana," Science, N. S., V. 50, p. 460, Nov. 14, 1919.

[57] La. St. Univ., Biennial Rp. 1924, pp. 111-116.

years' accumulation of dust, together with the destruction which insects had done to the old labels, made the task of proper identification of hundreds of specimens next to impossible.

"Since prior to 1922 little more than elementary courses in General Geology had been offered, and since any laboratory material, with the exception of maps, that had been used was not in evidence, and since the purpose of re-establishing the Department of Geology was to afford professional training in Geology and Petroleum Engineering to Louisiana boys so that they might compete with the University graduates from other states in the oil industry, it was at once necessary to devote attention to the gaining of the proper laboratory material.

"For the teaching of General and Historical Geology, the department was fortunate in having a large and very valuable collection of geologic and topographic maps. These were sorted, cleaned, classified by states, and arranged in proper condition for class work. A set of 1500 lantern slides was arranged and catalogued to illustrate the lectures, and a set of rock specimens was arranged to illustrate geologic processes.

"For the teaching of Mineralogy and Petrography a laboratory set of the hundred and seventy-five most common and useful minerals of the earth's crust was arranged to accompany Rogers' Course in Mineralogy. Chemical and blowpipe equipment for the determination of minerals was installed. A petrographic microscope was purchased during the fall term of 1922 for the microscopic study of rocks and minerals. This work became so popular that it was found necessary to purchase two more microscopes and a machine for grinding thin sections of rocks for the fall term of 1923, and to offer additional advanced courses in Petrography and microscopic study of sediments . . . and with the assistance of these advanced classes it has been possible to determine, label, number and index practically all of the several thousand rock specimens in the old collections.

"For the study of fossils the department collection was wonderfully complete on three horizons and partially representative of six other horizons, but was almost totally lacking in the remainder of the other known horizons of the earth's past history. Fortunately the department was able to obtain from the Zoology Department a collection of recent shells. (This was the Wailes' collection). This collection had been the property of the University for more than forty years and the original labels were for the most part still intact, but the specimens were mostly in the wrong boxes. To straighten this material out and make it serviceable it was necessary to obtain the proper publications on Conchology and by means of these publications and the assistance of the advanced classes in paleontology, these recent shells (more than 15,000 specimens, 1200 species), have been nearly all re-determined, numbered and card indexed and form the starting point for the study of the fossil faunas of Louisiana.

"For the study of Petroleum Geology the department was without equipment to start with. Fortunately this lack has been in large measure overcome by gifts of 2,500 well logs from the Arkansas Natural Gas Company; of bits and tool joints from the Hughes Tool Company; of cores, cuttings, fossils, and structure maps from most of the larger oil companies of Louisiana; by purchase of additional logs, of special equipment for the microscopic study of material obtained from wells, and of blue printing equipment for the reproduction of plotted logs and structure maps.

"All told more than thirty thousand specimens of rocks, minerals, fossils and recent shells have been identified, labeled, numbered and card indexed since the summer of 1922. Eleven new cases with 603 drawers, 18 in. by 25 in. holding 17,000 cardboard trays of determined material have been filled. Seven new display cases, two remodeled, and five old display cases have been filled with exhibits of rocks and minerals. Three hundred and fifteen old drawers have been filled with determined material which is ready to be card indexed. The collections have been more than doubled in size by gifts and by numerous collecting trips. The department which started out with 71 students at the beginning of the Fall Term of 1922 has grown to an enrollment of more than 150 students in all classes and of these more than forty are now specializing and working towards a degree in Geology or Petroleum Engineering. At the end of the 1923-1924 session seven seniors and one graduate student were registered for degrees from this department. This enrollment increased so rapidly as to necessitate the appointment of Mr. Charles R. Hoyle to instruct classes in Petroleum Engineering and Mr. Rhydon Grigsby as graduate assistant to index the collections.

". . . The department, beginning with the spring term of 1924, is undertaking at the request of the Southwestern Geological Society, a graduate extension course at Shreveport designed primarily to compile and form a permanent record of all that is known of the geology of northern Louisiana and southern Arkansas. . . . The department also plans to establish a temporary branch museum in Shreveport to receive the cores, cuttings, fossils, maps, etc., donated by the oil industry to aid the department in working out the geology of our state. The Louisiana State Conservation Commission has kindly offered to cooperate in this work by furnishing the department with the necessary room to house this material, . . ."

Mr. Karl E. Young was added to the staff of the department in the Spring of 1924 to take care of the Shreveport extension work and served through the session of 1924-1925.[58] And in the fall of 1924 the enrollment in the department had become so large that Dr. Ian Campbell was added to the staff as Assistant Professor of Mineralogy and Petrography.[59] Professor Campbell resigned some four years later and now holds a similar position at California Institute of Technology.

Other members of the staff who have served during the past ten years are:

Mr. Warren Jackson, 1925-1927, Assistant in Geology and Petroleum Engineering, filling the place of Charles R. Hoyle who resigned at the end of the 1924-1925 session.

Mr. Paul Post, Assistant Professor of Geology, session of 1926-1927.

Mr. P. H. O'Bannon, Instructor in Petroleum Engineering, sessions of 1926-1927, 1927-1928, and 1928-1929.

Mr. George Sellery, Assistant in Geology, session 1926-1927.

Dr. Richard J. Russell, Professor of Geography, 1928 to the present time.

Mr. Eli T. Monsour, Assistant in Paleontology, 1928-1929.

Dr. Fred B. Kniffen, Associate Professor of Geology and Geography, 1929 to the present time.

Mr. Benjamin C. Craft, Assistant Professor of Petroleum Engineering, 1929 to the present time.

Mr. Lloyd Pyeatt, Assistant in Geology, 1929-1931.

Dr. R. Dana Russell, Assistant Professor of Mineralogy, September 1931, to the present time.

Mr. John E. Galley, Assistant in Geology, September 1931, to the present time.

Mr. Marion U. Broussard, Assistant in charge of the department library, 1931-1932.

Mr. James McGuirt, Assistant in Petroleum Engineering, September 1932, to the present time.

Miss Louise Lowe, Departmental Librarian, September 1932, to the present time.

The Shreveport extension work proved a distinct success and resulted in the "Department of Geology . . . securing the cooperation of the State Department of Conservation in the financing of an extensive ceramic survey of the state, and in establishment of a Department of Ceramics at the University under the direction of Mr. John W. Whittemore."[60] The arrangement for the conduct of this survey and for the establishment of work in Ceramics at the University is described in the Biennial Report of the University for 1926,[61] as follows:

> "Realizing that an effort should be made to utilize more of the natural resources of the state, the State Department of Conservation, in co-operation with the College of Engineering of the University, recently instituted a survey of its clay deposits to determine their ceramic and commercial possibilities. A laboratory is being equipped at the University to test these clays and to train men in this line of work."

Professor Whittemore started his services on January 1, 1926, and during his term of office three papers were issued by the Department of Conservation giving detailed information on the clays of the Monroe, Shreveport, and Alexandria areas.[62]. He also published a short article on "Clays and Clay Development in Louisiana."[63]

The Clay Survey was terminated when Professor Whittemore resigned in 1928 to accept a position on the faculty of Virginia Polytechnic Institute.

The objective which President T. D. Boyd had in mind when he re-established the Department of Geology in 1922; that of training young men for the petroleum profession, has been fulfilled. Well over 100 graduates of the Department of Geology have entered the professions of Geology and Petroleum Engineering during the past 10 years and are numbered on the Surveys of New Mexico, Mississippi, the United States Geological Survey, the faculty of the University of Oklahoma, as well as the staffs of many of the major oil companies in this and foreign countries. The present writers will not attempt to describe the growth in equipment for instruction and in the University's museum, but will merely state that it has been at an even more rapid rate than that indicated between 1922 and 1924. While the faculty of the Department of Geology has not been provided with funds to conduct a Geological Survey, and all members have carried a full teaching load attendant upon the rapid growth in enrollment, nevertheless it has been productive of a number of papers dealing with the geology of the State.[64] In recognition of the service which this department was rendering, President J. M. Smith, shortly after his inauguration, raised the rank of the Department to that of a School.[65] The School of Geology now includes the work offered by the University in Geology, Geography, Anthropology, and Petroleum Engineering. With its increased faculty and large enrollment, the School of Geology had kept pace with the development of graduate research in the University. The graduate courses offered in the School of Geology constitute an important and integral part of the work of the new Graduate School of the University.

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[58] Catalogue, La. St. Univ., 1925, p. 219.

[59] Ibid., p. 219.

[60] Biennial R. La. St. Univ., 1925, p. 81.

[61] Ibid., p. 76.

[62] Whittemore, J. W., "The clays of Louisiana; Shreveport area," La. Dept. Consv., Bull. 14, 1927, 84 pp. il.

"The clays of Louisiana, (Monrot-Ruston area)," La. Dept. Consv., Bull. 16, 1928, 189 pp.

"The clays of Louisiana, (Alexandria area)," La. Dept. Consv., Bull. 19, 1929, 277 pp.

[63] Amer. Ceramic Soc., Jour., V. 11, No. 10, 1928, pp. 782-784.

The Department of Conservation under the able leadership of Col. Robert S. Maestri, deserves much credit for the aid which it has rendered the School of Geology. Through his assistance Mr. Cyril K. Moresi, Geologist for the Department of Conservation, was detailed to work with the School of Geology in preparing for publication papers on the geology of the State. Mr. Moresi started his services in June, 1931 and since that time two papers[66] have appeared and a third is in preparation.[67]

As a furtherance of this plan of research upon the geology of Louisiana, graduate students of the School of Geology are at present working on the following problems:

Julius Garrett: "Microfaunas of the Wilcox of Louisiana."

Frederick E. Smith: "The Oligocene Foraminifera of Louisiana."

Marion Roberts: "Microfauna of the St. Maurice Eocene type locality."

James McGuirt: "Louisiana Claiborne Eocene Bryozoa."

It is intended that these research problems will develop papers which will be of great utility to workers in the stratigraphy of Louisiana. In fact, it appears at the present time that the only real obstacle which prevents the School of Geology from conducting an active geologic survey of the State is the problem of supplying the graduate students with sufficient funds so that they may remain in school.

In conclusion, the senior author wishes to take this occasion to express his profound admiration for the pluck and scientific zeal which motivated his predecessors. In the long list which has been enumerated there are few who did not go to much extra effort, much personal expense, and who did not suffer much physical discomfort in attempting to present to the public a knowledge of the geology and mineral resources of our great state. These men, working with limited equipment, mostly with limited transportation facilities, and with limited or no funds, have built up an important scientific literature comprising 81 papers and volumes with a total of more than 4200 pages; a large number of topographic and geologic maps, including the only colored geologic map of the state yet issued; and have been responsible for obtaining the cooperation of the Bureau of Soils in making our Parish soil maps. The work of these men has been in large part responsible for the great mineral industry which Louisiana possesses today, and the State owes them a debt of gratitude. It is to their memory that the present authors respectfully dedicate this account.

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[64] Howe, H. V., "The Arkadelphia formation; historical summary," La. St. Univ., Bull., n. s., vol. 16, No. 5, pt. 1, June, 1924, 10 pp.

Howe, H. V., "The Arkadelphia formation, stratigraphy," La. St. Univ., Bull., n. s., vol. 16, no. 5, pt. 2, June (July) 1924, 17 pp.

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Howe, H. V., "Louisiana's mineral resources, past and present," The South's Development, Manufacturers Record, vol. 86, no. 24, pt. 2, 1924, pp. 378-381.

Howe, H. V., "The Many salt dome, Sabine Parish, Louisiana," Am. Assoc. Pet. Geol. Bull., vol. 9, no. 1, 1925, pp. 170-171.

Howe, H. V., "Extension of Midway formation into Louisiana," Pan-Am. Geol. vol. 43, no. 4, p. 309, May, 1925.

Grimm, M. W., and Howe, H. V., "New Waskom gas field of Louisiana and Texas," Pan-Am. Geol. vol. 43, no. 5, 1925, pp. 333-335, 1 map.

Howe, H. V., "An observation on the range of the genus *Hantkenina*," Journal. Pal. vol. 2, no. 1, 1928, pp. 13-14, 2 figs.

Campbell, Ian, and Miller, A. D., "Nepheline basalt in Richland Parish gas field, Louisiana." Am. Assoc. Pet. Geol. Bull., vol. 12, no. 10, 1928, pp. 985-993, 3 figs., 1 pl.

Kniffen, F. B., and Howe, H. V., "Physiographic history of Bayou Manchac, Louisiana," abst., Geol. Soc. Am., Bull. vol. 43, 1932, p. 247.

Kniffen, F. B., and Howe, H. V., "Physiographic history of Vermilion River, Louisiana," abst., Geol. Soc. Am., Bull., vol. 43, 1932, pp. 247-248.

[65] President's Report to the Legislature, May, 1932, p. 20.

"The Department of Geology, organized at the University in 1922, through the training given its students, has contributed to the conservation and development of the natural resources of the State over a period of 10 years. The number of students enrolled, the high rank of the faculty, and the demand for trained geologists warranted the elevation of this department to the status of a school. This school began to function in September, 1931."

[66] Howe, Henry V. and Moresi, C. K., "Geology of Iberia Parish," La. Dept. Consv., Geol. Bull. no. 1, Nov., 1931, 187 pp.

Howe, Henry V., and Wallace, William E., "Formation of the Jackson Eocene at Danville Landing on the Ouachita, Catahoula Parish, Louisiana," La. Dept. Consv., Geol. Bull. no. 2, Sept., 1932, 118 pp.

[67] Howe, H. V., and Moresi, C. K., "Geology of Lafayette and St. Martin Parishes, Louisiana," La. Dept. Consv., Geol. Bull. no. 3.

IN MEMORIAM

Edward Stiles Hopkins - - -

Department's Ornithologist
Passes On

"TAPS"

Oh! listen all ye beasts and birds of field and fen
Know ye not, ye've lost your friend?
That when "Taps" sounded o'er Ed. Hopkins' bier
Almighty God took from this earthly sphere
One who held you always dear.

We too, of this human race,
Will bitterly miss his smiling face
And sincerly hope and humbly pray
That, on some gloriously happy day,
In Heaven's halls we'll meet again
And renew old friendship, when,
With Cherubim and Seraphim,
In sweet accord, we join with him
In the great, unending, celestial hymn.

E. B. COPE.

IN the death of Edward Stiles Hopkins on Sunday, March 19, 1933, at nine o'clock a. m., the cause of Louisiana's wild life conservation suffered an appreciable loss. Mr. Hopkins served the department in the capacity of ornithologist and taxidermist. In this connection his activities were largely taken up in the Wild Life Division and the Bureau of Education. His duties with the Bureau of Education included lecturing to the schools of the state and cooperating with organization such as the girl and boy scouts.

EDWARD STILES HOPKINS

Mr. Hopkins was born in Augusta, Georgia, August 18, 1872, spending his early life in Georgia and Alabama where he was employed by the railroads and the Alabama Power Company. From his earliest boyhood he had been intensely interested in the wild life of the country and had devoted practically all of his spare time in its study and in the furtherance of its conservation. After having served his country as a volunteer in the Spanish American War under Colonel Twigs of the Second Georgia Infantry he came to this state, as it offered the greatest opportunities for the completion of his bird and wild life study. It was then that he became associated with the Louisiana State Museum and this department.

Mr. Hopkins was married to Miss Glenn Hurley of Jasper, Alabama, who, with her devoted husband, has given much time to conservation activities and conservation education.

Annual Report of the Bureau of Scientific Research and Statistics

1932

Colonel, HU B. MYERS, Director
JAMES N. GOWANLOCH, Chief Biologist
JOHN MIZELLE, Zoologist
FORREST V. DURAND, Assistant Biologist
CYRIL K. MORESI, Geologist
ALBERT D. MILLER, Paleontologist

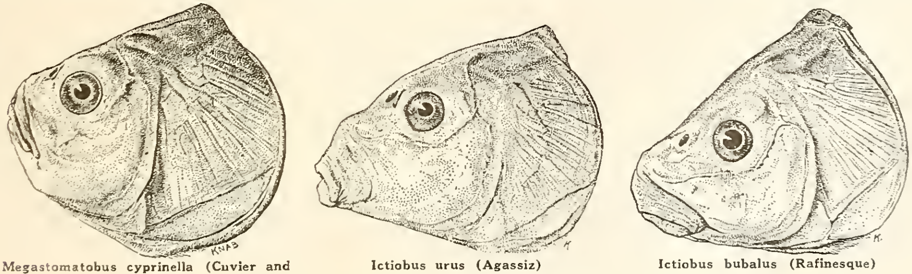
THE following report covers the activities of the Bureau of Statistics of the Department of Conservation for the year 1932.

In addition to the major activity of its participation in the cooperative shrimp investigation program, the Bureau has been called upon more and more to consider diverse important problems which have arisen in relation to the conservation of natural resources. Detailed reference to certain of these problems will be given later in this report. Furthermore, an increasing number of most varied inquiries have received the attention of the staff of the Bureau.

The Bureau of Scientific Research and Statistics has, during the year here reported upon, inaugurated an important system by means of which the Department of Conservation will, for the first time in history, receive, preserve and analyze shrimp catch reports of scientific value. The importance of this progressive step cannot be over-emphasized since the knowledge provided by such statistics is the only means whereby it is possible to understand the real state of the natural supply of commercial shrimp. With such detailed and complete statistics of the commercial catch at its command, the Bureau of Research will be able to estimate, accurately, the fluctuations in the shrimp supply and will be thus in a position to protect, by means of appropriate protective legislation, this excedingly valuable marine resource in event of depletion. The necessity for such a continuous and careful check upon the state of the shrimp supply is greater in the light of the knowledge already gained of the life history of the commercial sea shrimp. The results already secured by the shrimp investigation program have revealed that the industry is based upon a short-lived animal, which, entering the commercial catch when only several months old, appears to spawn when but one year of age and thereafter to die.

Shrimp Research Progresses

The Bureau continued as its major activity the cooperative shrimp research program in association with the Bureau of Fisheries of the Federal Government. As before, the headquarters for the Federal investigation were maintained in New Orleans and the same Federal personnel continued their part of the work. The Bureau of Research continued, as one part of its program, the maintenance of the research vessel, "Black Mallard," the provision of this vessel with its captain and working crew, and the conduct of a designated portion of the scientific work. The Bureau of Research has carried on, as part of the Shrimp Investigation, the collection, analysis and study of water samples which, taken concurrently with the biological sampling carried on by the other investigators, provides essential information for the understanding of the abundance, movement and welfare of the shrimp, the basis of Louisiana's most valuable fishery. Concurrently with

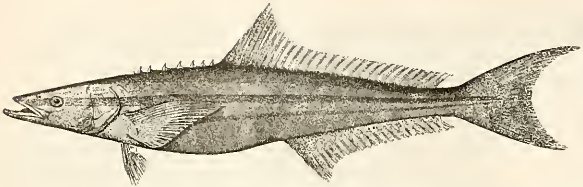


Megastomatobus cyprinella (Cuvier and Valenciennes) Ictiobus urus (Agassiz) Ictiobus bubalus (Rafinesque)

LOUISIANA BUFFALO FISHES

The above illustration shows the head characters of the three different species of Buffalo fish that occur in Louisiana. The Buffalo fish catch of the whole Mississippi Valley may reach the enormous figure of seventeen million pounds with a value of over one million dollars for a single year. The Bureau of Research has answered frequent inquiries regarding the rearing and care of Buffalo fish in farm ponds.

The Department of Conservation has established a Buffalo fish hatchery at Lake Des Allemands to aid in perpetuating the supply of this useful food fish.



THE COBIA, LEMON FISH OR LING
Rachycentron canadus (Linnaeus)

A fine food fish, exceptionally game when taken with sporting tackle, the Cobia is known in Louisiana waters as the Ling or Lemon Fish. It is one of the many species of our sea fishes concerning which information is constantly sought from the Bureau of Research by interested anglers.

the collection of water samples, studies have been made of the turbidity of the water, the hydrogen-ion concentration and, of especial importance, accurate temperature recordings at surface and various sub-surface levels by means of Negretti and Zambra reversing thermometers. The shrimp research program has already provided abundant and valuable data concerning the movements and life history of commercial shrimp. For the first time a clear idea of the duration of life and major features of life history of commercial shrimp has been obtained. A report covering results already secured has been prepared by the Federal staff and will presently be published.

Two papers covering the Bureau of Research's participation in the shrimp program were presented at the International conferences in Baltimore during 1932 by the Chief Biologist of the Bureau. The first of these summarized the importance and the results of the hydrographic studies being carried out and the relation of such studies of water conditions to the understanding of commercial fisheries necessary in conservation work. The second paper outlined the new method inaugurated by the Bureau of Research for the collection of adequate shrimp statistics, data likewise essential for the framing of adequate conservation laws. Reference to this activity will be given later in more detail.

During the year one considerable break in the systematic program of the Research boat was caused by the necessity of sending the "Black Mallard" to northern Louisiana on flood relief work during the months of January, February and March.

The total number of trips made by the Research boat in the conduct of the Shrimp Investigations was 22 for the year with a total number of days at sea of 151. The regular program calls for two trips each month, one in the first half and one in the second half of the month. The trips at sea are usually seven to ten days in length and this time is chiefly spent in the shallower coastal waters of Louisiana where are centered the most important commercial shrimp fishing areas. In addition to her crew of three members, the "Black Mallard" carries a staff of two or three scientists on every trip. On several occasions visiting scientists have, upon invitation, participated in a Shrimp Investigation trip for the purpose of carrying on special studies on other commercially important marine problems of Louisiana, such studies, however, altering in no way the regular performance of the shrimp program.

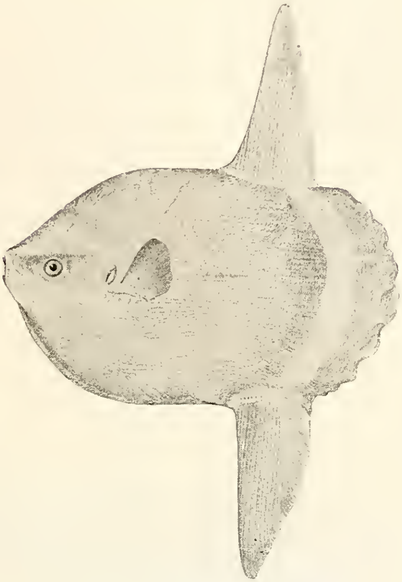
The "Black Mallard" is now well equipped with gear of commercial specifications for shrimp trawling, together with an excellent equipment of the necessary scientific instruments for carrying on precise marine studies of those changes occurring in the sea which affect the movements and behavior of shrimp. Such instruments include, for example, Greene Bigelow water bottles and Negretti and Zambra reversing thermometers, cases, bottom samplers of various types, instruments for the measurement of the turbidity of water, apparatus for the accurate study of changes in the acidity and alkalinity of sea water, and a very complete equipment of plankton nets and other apparatus, by means of which careful collections are systematically gathered of the microscopic early stages of the commercial shrimp. A brief summary, presenting some of these results, accompanies the present report of the Bureau of Research.

Of exceptional interest are the facts indicated concerning the spawning and growth rate of the

THE MISSISSIPPI ALLIGATOR GAR
Atractosteus spatula (Lacepede)

The largest of our three species of Louisiana Gar Pikes, the Alligator Gar is extremely destructive of game fish and other wild life. The Bureau of Research of the Department of Conservation is investigating all available methods for the destruction of Gars. Louisiana Conservation laws require that all Gars caught by anglers be killed before returning them to the water.

commercial shrimp. As will be found by reference to the accompanying report, the commercial shrimp appear to spawn in outside waters and the young to pass the early stages of their growth in inside waters. The systematic measurements of shrimp by members of the Federal staff indicate a surprisingly high growth rate, reaching as much as an inch and a fifth in a month. Probably the outstanding fact revealed by these studies is the apparent brief life of the shrimp. The evidence indicates that shrimp spawned in the spring compose the bulk of the following autumn fishery and that the shrimp, spawning at the age of one year, thereafter die. The significance in conservation of such a brief life cycle is extreme and is further discussed in the accompanying report.



THE OCEAN SUNFISH OR HEADFISH
Mola mola (Linnaeus)

Grotesque in shape, this species has been appropriately called the Headfish. Attaining a weight of over two thousand pounds, the Ocean Sunfish is one of several species of its family occurring in the Gulf of Mexico. Its peculiar appearance has occasioned various inquiries at the Bureau of Research of the Department of Conservation. The Ocean Sunfish is a cosmopolitan species, ranging over the warm and temperate seas of the world.

New System for Shrimp Statistics Inaugurated

One unusually important contribution to the systematic collection of necessary basic data for conservation has been made this year in the inauguration of the new type of commercial shrimp reports. A definite knowledge of the abundance of any commercial sea product is the primary aim of all fisheries investigations, as a thorough understanding of the abundance is necessary in order to protect the industry, to insure the people of the state depending upon the fishery, and to maintain a supply for future generations. An adequate statistical record of the "take" in any commercial fishery is the basis for all estimates, either exact or approximate, of the status of abundance of that particular fishery. Total monthly or yearly catch records are of value in determining the seasonal distribution of the catch and the annual progress of the industry, but in themselves are of little value in any abundance analysis. In order to arrive at an estimate of abundance from year to year, it is necessary to have, besides an exact record of the animals taken, accurate statistics concerning the amount of effort expended in securing this catch. The total yearly "take" or catch in any fishery which is not seriously depleted is dependent upon many variables such as number of men fishing, economic conditions, number of boats in the fishery, weather conditions, types of gear used in fishing, legal restrictions, etc. As one or all of these variables change, so changes the amount of the catch. With so many alterable factors, it can be readily seen that total catch in itself cannot be used as an indication of abundance in a fishery. On the contrary, the trend of the yearly "take" quite frequently leads to highly erroneous conclusions.

Report forms that will provide the necessary information have been prepared and printed in convenient book form. The cooperation of all concerned with the final commercial handling of the shrimp catch has been secured. For this purpose, the Director of the Bureau of Research made personal visits to the chief firms concerned.

The new system of shrimp reports went into operation in September and will thus provide the Department of Conservation for the first time in its history with statistical information of scien-

THE GAFF-TOPSAIL OR FOUR-WHISKERED SEA CAT
Bagre marina (Mitchill)

This abundant little salt water Catfish, which so often exasperates the angler by stealing his bait, is one of two closely related Louisiana species remarkable for their breeding habits. Like the Hardhead, **Galeichthys felis** (Linnaeus), the male Gaff-topsail exhibits the astonishing custom of carrying the eggs around in his mouth until they hatch and afterwards similarly caring for and transporting his young offspring.

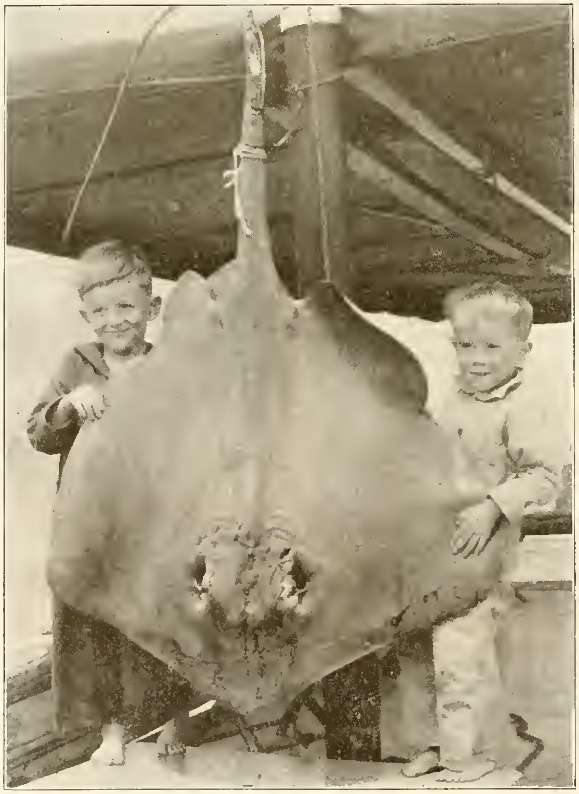
tific value for ascertaining fluctuations in the natural supply of commercial shrimp.

Cooperation With Tree Planting Work

The Director of the Bureau of Research has been engaged since February 20th, 1932, in representing the Commissioner of Conservation in his cooperation with the Highway Department, the Parking Commission of the City of New Orleans and the Welfare Committee of the same city in beautifying the New Orleans-Chef Menteur-Rigolets road by planting trees alongside the said road.

Bureau Participates in Bayou Lacombe Hearing

On November 15th, 1932, the Director of the Bureau of Research, Colonel Hu B. Myers, representing the Commissioner of Conservation, attended an open meeting, held by the United States District Engineer, at which the matter of an appropriation by the Federal Government of funds for dredging the bar at the mouth of Bayou Lacombe was discussed. The result of the hearing was that the District Engineer recommended that the said bar be dredged from within Bayou Lacombe to the eight foot contour in Lake Pontchartrain to a depth of eight feet and that the cut be made sixty feet wide. This recommendation was approved by the Chief of Engineers, United States Army, and sent to the House Committee on Rivers and Harbors, with the recommendation that the necessary money be appropriated and made available in one sum.



THE STINGRAY OR STINGAREE
Amphotistius sabinus (LeSueur)

Stingrays of various species occur in the costal waters of Louisiana. Armed with powerful saw-toothed spines, Stingrays are capable of causing extremely painful wounds. In spite of its ugly appearance, the "wings" of this fish, when properly prepared, form an excellently palatable dish.

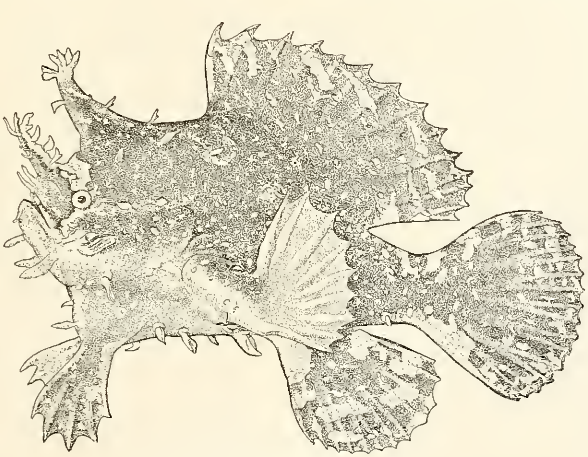
Game Bird Problems

The Bureau of Research and Statistics has given attention to the possibilities of the introduction of game birds. One matter of paramount interest to sportsmen is the maintenance of an abundant supply of desirable game birds. The natural game birds and other animals of a region are subject, as has been long known, to strange and still unexplainable periods of increase and decrease in their numbers. However, apart from these so called "natural cycles" there is also the steady influence of man producing, by his activity as hunter and sportsman throughout the continent, a progressive depletion of game resources. There exists, therefore, a twofold possibility, first the maintenance of game birds naturally present by protective measures such as strict enforcement of seasons, closely restricted hunting and in some instances propagation. The second possibility is the introduction, propagation and distribution of appropriate foreign game birds so that by the united effects of such measures a satisfactory game supply may be insured for the sportsman.

The Bureau of Research has been carefully examining the possibilities of such introductions since it believes that results of great value might be secured from, for example, the use of suitable species of pheasants.

Pheasants range in nature through an immense variety of country, from snowy mountains to low and humid tropical forests. Pheasant introduction into the United States dates back at least to the time of George Washington, when the First President received at Mount Vernon a gift of Golden Pheasants from Lafayette in 1786. Since that time a great number of introductions have been experimentally made, some by public agencies such as federal, state and civic governments and some by private individuals, some under carefully watched conditions and some mere releases without further study or care. The results so far attained have varied from complete failure in some instances to quite astonishing success in other instances, such as, for example, in the State of Pennsylvania where more than fifty thousand Ring Necked pheasants are legally shot during the short open season every year, while in New York and Washington the annual pheasant shoot in each of these States exceeds the surprising total of over one hundred thousand birds. Furthermore, the Bureau of Research has been authoritatively informed that the officially reported "shoot" of pheasants in the State of Minnesota, alone, for a single year, exceeded one million birds.

The Bureau of Research is gathering extensive and accurate data covering the possibilities of such game importation so that desirable steps may be taken to care for the interests of Louisiana sportsmen.



THE SARGASSUM FISH OR MOUSE-FISH
Histrio pictus (Cuvier and Valenciennes)

The Sargassum Fish is one of the very many species of Louisiana fish concerning which constant inquiries are directed to the Bureau of Research. A member of the so-called Fishing Fishes, the Mouse-fish leads a most peculiar life and has become much changed in appearance in adaptation to its habits. The Mouse-fish lives in the drifting masses of Sargassum weed in the Gulf of Mexico along the Louisiana coasts. Its fins have come to be provided with almost finger-like processes by means of which it clings to or perches among the strands of sea weed. Body and fins alike have become covered with small tab-like extensions of skin which closely resemble, in both form and color, the fronds of sea weed. The Mouse-fish lays a ribbon-like "veil" of eggs. Several different species occur in Louisiana waters.

PARTICIPATION IN INTERNATIONAL CONFERENCES

The Department of Conservation participated in the International Conferences of the 26th Convention of the International Association of Game, Fish and Conservation Commissioners and the 62nd Annual Meeting of the American Fisheries Society held in Baltimore, September 19th to 23rd, 1932. The Chief Biologist of the Bureau of Research was one of the two Departmental delegates to these meetings and, like the other representative of the Department, was called upon to serve upon committees of both Associations. The Chief Biologist also presented two papers at these Sessions, "The Importance and Conduct of Hydrographic Studies in Louisiana in Relation to Commercial Fisheries" and "The Practical Importance of Securing More Precise Statistics of the Shrimp Fishery." In the first paper a summary was given of the program of water studies which is being systematically carried out by the Bureau of Research as part of the cooperative shrimp investigation. The practical importance of such studies was indicated and the unusual character of some of the Louisiana hydrographic problems was described. Variations in water conditions and their effects upon commercial fisheries were discussed, based upon the systematic collection and analysis of over 3,000 samples, together with accurate simultaneous temperature determinations. It was emphasized that it is becoming progressively more clear that even the most hardheaded conduct of a commercial fishery requires for its continued success that it be pursued in proper adjustment to the continued abundance of the animals fished. Such an adjustment in turn inevitably depends upon a knowledge of the life history, the movements and the reproductive success of the commercial form, whatever its species. Physical factors such as salinity, turbidity and temperature, exert the profoundest influence upon the commercial fishery. Such influences are of highest practical value and must be systematically measured and analyzed.

In the second paper the necessity of securing more precise statistics than are now available was explained, since such statistics are the essential basis for proper understanding and protection of the shrimp fishery. The methods by which these more precise returns will be secured were described and the highly practical value which they will afford was explained.

NEW FISH BULLETIN

At the beginning of the year an illustrated bulletin, prepared by the Chief Biologist, was produced entitled "Sea Fishes and Sea Fishing in Louisiana" in which accounts were given of those salt water fishes which were most important for game or commercial purposes, together with certain other sea fishes of exceptional interest either because of curious appearances or extraordinary habits. It was hoped that by this publication, not only would many not generally understood aspects of Louisiana's rich game and commercial fishing be brought to attention, but in addition, the bulletin would serve to answer many questions relating to fishes remarkable by appearance or habits. Although an edition of some 8,500 of these bulletins was printed, the supply of the publication was exhausted within a few weeks.

The Chief Biologist of the Bureau of Research was asked to extend the scope of the bulletin so that fresh water as well as salt water fishes would be included. These instructions were carried out and the new publication, which has appeared before the printing of the present report, is the most comprehensive discussion of fishes yet issued by the Department. A volume of somewhat over 600 pages, the new fish bulletin presents, under the title "Fishes and Fishing in Louisiana," an extensive, well illustrated discussion of Louisiana's fishing resources. The publication is composed of five parts. An introduction to fishes and fishing in general including a comprehensive discussion of angling for sport, by Colonel Hu B. Myers, Director of the Bureau of Research and Statistics; a detailed account of Louisiana salt water fishes, chosen for their importance in sport or commerce; a similar discussion of similarly chosen Louisiana fresh-water fishes, together with description of the methods of rearing fish in farm ponds; a summary of the fish laws of Louisiana, together with the text of the laws relating to fish, shrimp and oysters, prepared by Mr. James P. Guillot and Mr. Nicole E. Simoneaux; and lastly, a compilation of certain distinctive southern methods of preparing fish, both fresh and salt water, and other sea foods.

"Fishes and Fishing in Louisiana" is well illustrated, containing about 170 black and white illustrations, 9 excellent colored plates and various maps of fishing areas. Its purpose is to describe the remarkable richness of Louisiana waters in fishes of interest both to the sportsman and to the commercial fisherman and to bring within the covers of a single bulletin a great deal of information that will answer many of the fisherman's questions and will aid in the practice of the art of fishing.

FISH HATCHERY PROBLEMS

The Director of the Bureau of Research has been engaged in the consideration of the most improved and satisfactory methods in the construction and management of fish hatcheries and the most efficient methods for the distribution of fish hatchery output. It is obvious that the Research Bureau should serve as the clearing house for special problems that arise in the operations of the various fish hatcheries of the Fisheries Division of the Department of Conservation.

Numerous other matters relating to fisheries, both game and commercial, are constantly brought as problems to the Bureau of Research.

SURVEY OF WILD FOWL

The Director of the Bureau of Research has spent much time and effort in the survey of the Louisiana wild life sanctuaries and the control there of predatory animals. These bird refuges, because of their geographical situation with reference to the winter ranges and migration routes of our bird life, possess an importance probably unequalled by any other area in the whole Continent. Dr. Harry Church Oberholser, the distinguished ornithologist of the Bureau of Biological Survey again visited Louisiana during December, 1932, January and February, 1933. The Director of the Bureau of Research made the arrangements for the itinerary of Dr. Oberholser's water fowl studies in Louisiana and accompanied Dr. Oberholser during the conduct of his investigations. It was again Dr. Oberholser's purpose to survey the water fowl situation throughout the whole United States and portions of Canada in view of the long series of events and circumstances which have contributed so greatly to the reduction of numbers of water fowl, especially during the past few years. Dr. Oberholser, who a number of years ago initiated the water fowl surveys, which are now a regular source of information in the administration of the related game laws, received all possible cooperation from the Bureau of Research in the pursuit of his important investigations. The object of such a census of these game resources of the state is to secure the facts upon which must be based recommendations as to hunting season 1933-1934.

MUSKRAT PROBLEMS

The Bureau of Research has undertaken the investigation of certain muskrat studies in the important fur-bearing areas of the state. Arrangements have been made with Dr. Joseph D'Aunoy, Pathologist at Louisiana State University Medical Center, for his cooperation in the pathological examination of specimens of wild life suspected of disease infections. In this connection we are now concerned with numerous deaths of muskrats which have occurred in the marshes and with an investigation to learn the extent of the infestation of tularemia among the rabbits, as well as the mysterious malady which has resulted within the year in the death of a number of pelicans.

Cooperating with the Division of Wild Life, the Bureau of Research has given consideration to the pursuit of muskrat field studies by a member of the graduate school of the Department of Zoology of Louisiana State University, Mr. Jno. D. Mizelle. Preliminary work was carried out at Marsh Island, the great game preserve presented to the State of Louisiana by the Russell Sage Foundation and administered by the Department of Conservation.

INCREASINGLY VARIED INQUIRIES ANSWERED

In addition to all its other duties the Bureau of Research and Statistics has had the task of answering innumerable inquiries relating to the most diverse subjects and has performed the service of either directly providing the desired information or else indicating to the correspondent the correct sources to which they should apply. For this work it is necessary that the Bureau develop a soundly chosen, up-to-the-minute, scientifically accurate reference library. This important work of the Bureau of Research is being attended to, so that the Bureau is rapidly becoming a clearing house for dissemination of accurate information on subjects which relate to the remarkable natural resources of our State.

As examples of the diversity of problems presented to the Bureau of Research, reference may be made to two. A proposed sulphur development in southern Louisiana involved the release of five million gallons of water a day and advice was sought as to the possible effects of this waste "bleed water" on the oyster beds and fisheries of the neighboring region. The Bureau of Research took the matter under advisement and due to the fact that this Bureau already had in progress a hydrographic survey which included the region, thus making available data on the tidal movements involved, and the additional fact that the Bureau has been conducting exact chemical analyses of sea water and for this purpose has in operation a well equipped chemical laboratory, it was possible for the Bureau of Research to provide an opinion based upon an analysis of facts. The second example indicating the wide variety of problems presented involved a report upon the poisonous character of tarantulas occurring in banana shipments. This matter had become of high economic importance for one of the large fruit companies. In response to their inquiry, therefore, the Bureau of Research got in direct communication with the leading authorities in the world on the effects of the bites of the various species of tarantulas and was able to provide the fruit company with a summary of all that is at present known on the subject and thus give them, immediately and precisely, facts that were of much value to them.

Some of the illustrations accompanying this report indicate examples of the diversity of information which has been supplied in response to inquiries directed to the Bureau of Research. The identification of fish specimens and other animals, the provision of technical data concerning new developments in freezing methods, and the supplying of descriptions of methods of preparing soft shell crabs in reply to repeated inquiries relating to this and other matters involved in commercial crab fishing, these are but a few of the problems concerning commercial fishing and other natural resources of Louisiana which have been presented to the Bureau of Research of the Department of Conservation for solution.

RESEARCH EQUIPMENT

The Bureau has built up carefully selected, efficient equipment for the conduct of researches it has undertaken. The organization of such equipment involves a great expenditure of effort and time, especially in the carrying out of some of the investigations involved in the Shrimp Program, since the instruments necessary for such precise scientific work are often not commercially available but must be built in accord with specifications drawn up for the exact problem or must be secured from scientists, often from distant countries, who are specialists in the design of such instruments. The Bureau of Research has concurrently built up a well equipped chemical laboratory for the conduct of the innumerable experiments and analyses it is called upon to perform in relation to the Shrimp Investigation. The research vessel has been supplied with the most effective working equipment for the performance of the researches at sea, so that the results obtained will fulfill the high standards of precise scientific work.

The Bureau of Research has further engaged in the accumulation of data from all sources covering the wide field of its responsibilities so that the immense variety of problems which come to it from the citizens of Louisiana can be given solution. Some indication of the character and diversity of these problems has been given elsewhere in this report.

The Bureau of Research has earnestly attempted to build up an adequate reference library covering the most important matters involved in its work. The need for such a source of accurate up-

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Need for Educated Man Power

By Major
L. W. T. WALLER, Jr.

With Particular Reference to Game Conservation

WHENEVER those interested in wild life conservation get together, it appears misunderstandings must arise. All too frequently, these end in acrimonious which leave bad tastes in the mouths of all, and far from doing wild life any good, do harm by fogging the issue and making the whole problem harder to comprehend.

Some of this is due to a lack of understanding of the terms used, or what they are intended to convey; and if we narrow the scope of wild life conservation, to game conservation, the misunderstandings increase. There are those who think it incompatible to be a hunter and a conservationist at the same time.

Many of the difficulties which arise between conservationists come from a lack of understanding of what constitutes the problem of conservation itself, what it really is in all its ramifications. Thus, with no accepted definitions, no yard stick to measure by, they are at sea. They often understand some phases of the problem, yet fail to see what it is in its entirety. If this be true of conservationists, who are studying the problems of conservation closely, how much more must it be true of the general public who seldom give it a thought.

Let us try to set up a definition for "game conservation" which will be understood by all. Then, in the light of this understanding, try to determine what game conservation really is, what is wrong with it if its operations are not at present satisfactory, and finally, what we can do about it to make it better; to assist in building a conservation structure on a firm and lasting foundation. To do this we must attack the problem in a businesslike way, using the head and not the heart in its solution. The application of sentiment to wild life has produced some wonderful works of art and of literature, but has developed no workable system.

MAJOR L. W. T. WALLER, JR.,
Nationally Known Conservationist

A DEFINITION

A study of other activities composed of the same elements as game conservation will impress us with its similarity to forestry or agriculture.

In forestry the major branches are given as: Silviculture, Management, Protection, Utilization and Policy. Silviculture is defined as: "that branch of arboriculture dealing with forests and forest trees." If the term "game conservation" is taken to mean to game what silviculture means to forestry, or that branch of wild life conservation dealing with the game species, then the other branches of forestry fit in a logical way, and we have: Game Management, Game Protection, Game Utilization or hunting, and a Game Policy.

By game conservation, then, we mean broadly the whole subject of game and its several species, the relation of game to man and his economic and aesthetic life, its history, evolution, utilization, and all those methods of protection and those practices necessary to produce game on the ground. Time will develop a suitable nomenclature which we now lack.

The establishment of any sound game system resolves itself into three phases: Understanding, Organization and Production.

WHAT GAME CONSERVATION IS

Game is a crop, like trees of the forests or like corn or potatoes, in which seed to produce annually recurring returns. No forester would cut out all his seed trees and no farmer would use up all his seed corn or potatoes. Just so the sportsman must consider his seed or breeding stock of game, must save it, nurse it, protect it, to the end that he will have a supply for the next year's harvest.

Crops of trees or farm crops are affected by factors, both good and bad. The good husbandman reduces the bad factors to a minimum by the use of management methods, and increases the good factors to a maximum, that his crops will be as fine as it is humanly possible to make them. The methods employed largely determine the success or failure of his crops. Fertilizers are used to provide food for the plants, supplying deficiencies in the soil. Cover crops are sometimes employed to protect the primary crop. No good husbandman will plant crops which cannot mature due to climatic conditions. Insect parasites attack the crops and would reduce them or make their maturity impossible were it not for the constant warfare of protection waged with sprays, and eternal vigilance.

Thus we see the principal factors controlling forest or farm crops are: cover, food, climatic conditions and protection. These are also the controlling factors of the game crop. In game work they are called environment; and their handling, environmental control or game management. Where there is good environment, usually the game supply will be plentiful. Where environment is bad, game is scarce or lacking altogether, depending on the degree of prevalence of unfavorable factors. A complete lack of food, for example, will make it impossible for game to exist, even though all the other factors be of the best.

In this country, generally speaking, where the environment is good, it is good accidentally and not through the application of the principles of game management. This condition may be due to a small percentage of land under cultivation resulting in an abundant supply of food and cover, or some similar reason existing from natural conditions, and not as a result of attempting to increase the supply of game. In the future it is apparent that, to maintain or increase the game crop, good environment must be artificially produced, if game is to withstand the onslaughts of a constantly increasing density and mobility of population, coupled with a decreasingly favorable environment or habitat.

In order that environmental factors favorable to game may be produced artificially, what constitutes these factors in detail must be known. Their application to the ground by rule of thumb must be of general knowledge amongst the workers of the soil. To know what constitutes important factors of environment, we must go to research, for it is a well established fact, denied only by those of ostrich-like tendencies for hiding their heads in the sand, that very little authentic data is available on what factors affect the game crop, how they affect it, and why. To illustrate this point we have only to consider the various classifications of vermin, wherein all, good, bad and indifferent, are at times marked for slaughter —and some, are probably amongst the sports-

Paved highway through Louisiana forest, making game more accessible.

man's best friends. Or consider the lowly rabbit; known to all, whose habitat is pretty much all the country—what is his "cruising radius" or how much ground does he use or need? These simple facts are essential if we would place sanctuaries correctly and operate them successfully. This and other data must be known for all species, and as far as I know, no one can answer these questions.

Even if the factors controlling the game crop were fully known, there would still be complications, not the least of which is the fact that, in most instances, game would, of necessity, be a secondary crop of the land. Thus the application of environmental control measures must become compromises. This particularly applies to those farm-land-game crops which have an important bearing in the development of any satisfactory game system. They are the game crops most accessible to the mass of urban hunters, and the ones which give promise of the best financial returns to the land owner.

It is well to note carefully the assumption that game is a crop of the land, this fact can be considered an axiom, and yet it is not generally so thought of. Based on this assumption, however, is a possible means of solving the problem.

Time will only permit touching a few high spots in attempting to outline what game conservation really is, these high spots can be taken to indicate the nature of the problem before us, and not as a complete coverage of the subject. Obviously, it is pretty much of a profession in itself; its similarity to forestry and agriculture are apparent. We can liken game conservation to a gigantic jig-saw puzzle, a picture made up of many curiously shaped parts, no one of which will enable us to see clearly what the whole picture is, and without each one, in its proper place, the whole picture can never be completed. Some of the parts we know as: All the various foods for game, availability, necessity and seasonal variation; covers of all types and kinds; climatic effects; biological laws; the operation of economic laws, for certainly no satisfactory game system can be devised or will last if it runs counter to economic laws; methods of protection from both natural enemies and man; aesthetic values; political considerations; legislative enactments and a host of others, many doubtless undreamed of at this stage of the development of game conservation.

Some of us see the individual parts of this jig-saw puzzle; as these parts seem logical, think we see the whole picture and frequently become intolerant of all other views. There is also the natural human tendency to take only those parts of the whole picture which best fit into our desires, and to consider them the whole picture.

One group of conservationists will pin its faith on legislation, demanding more and better laws; ignoring the fact that laws, as necessary as they might be, do not plant food, and game may be starved to death as well as shot to death. Another group will advocate the artificial raising and release of game as the solution to the problem, but quail released on the corner of 5th Avenue and 42nd Street would hardly thrive. A foolish example possibly, but really no more foolish than some of the things which are now done in the name of game conservation. We consider this example foolish because we happen to know better, there are lots of things we do not know about.

Another group do not believe in killing anything, to them the jig-saw piece of protection is the whole picture; yet a plot of ground clean-farmed by present day methods, or a marsh drained in the name of agriculture is deadlier than the hunter's guns. There is also the killer group, who believe they have the right to kill anything and everything, in unlimited quantities, and at any time.

None of these groups, used as examples, are entirely right; none of them entirely wrong. Laws are necessary but are not to be depended on alone; artificial raising and release of game is at times desirable, but unless game released can live on the land, its release is like pouring water down a rat hole for all the good it does. To kill or not to kill, as a moral question, is a decision each must make for himself. From the standpoint of game conservation, it is necessary to kill at times, to prevent killing at other times, and to regulate the killing at all times. The seed stock must be preserved, and sportsmen must develop a code of ethics above reproach.

Thus, to me, game conservation means a great deal and its full development is a matter of time. It is a profession in itself, requiring the understanding of several of the sciences. It goes into natural history, biology, ecology, mammalogy, forestry, agriculture, economics, law, politics, administration and others. It is a lifetime study and not the hit-or-miss proposition it is now apparently supposed to be. It requires the coordination of the most divergent and unrelated interests; the road commissions in a state can materially reduce the percentage of hatch of upland game by cutting the grass and weeds on the roadsides during the breeding season, and do. There are other bureaus or offices of state governments whose activities have a bearing on game, but who are not brought into the picture to help protect or promote the huge economic asset to the state, that game is today. Why?

This, then, is a feeble attempt, limited by time, to outline what game conservation really is. We do not have to know it all, or understand it all to realize that it is a big job, requiring brains.

WHAT IS WRONG WITH GAME CONSERVATION

If we accept the scope of game conservation as outlined, it is an easy matter to find many things wrong with its present operation. For the sake of brevity I would classify the most glaring faults under five major headings: 1. The existing lack of understanding of the problem. 2. Lack of adequate research. 3. Lack of educated man power. 4. Lack of an accepted game policy. 5. Lack of cooperation.

1. Lack of Understanding of the Problem

It has been said that to define a difficulty is to go a long way toward its solution. If we understand the problem which confronts us the proper method of starting its solution should be indicated. The development of a satisfactory game system, is actually the development of the various factors which go to make up what we have called game conservation, and their correct handling. We can only make a start at this time, but to make a correct start, we must understand in a general way what the problem is and where it leads. We can hardly take a north bound train and expect to go south on it.

At present the general public only knows the restrictive side of game conservation. This method is inadequate as far as protection goes, and from the standpoint of the hunter, can only lead to complete closure of all hunting if productive methods, and the machinery for production, are not established.

2. Lack of Adequate Research

If we recognize certain problems as existing, and that these problems lead into applied biology, for example, we should be ready to admit the necessity for research. There exists a curious antagonism, on the part of many sportsmen, to all forms of research. They consider it impractical and want to see what they call practical methods employed. This attitude is unreasonable, born of a lack of understanding of what is to be gained by research, and yet there may be some grounds for it. The game commissioners are partly to blame for not using the findings of research more often to solve their problems, and in not telling the sportsmen about it in popular language. To the scientist, a problem is an abstract thing to be solved; when this is accomplished, he is through and it no longer interests him. His reports are cold, uninteresting, and generally lean over backwards to prevent making positive statements or to predict probable results, which might later be disproved and ruin his reputation as a scientist.

To the sportsman, science is a means to an end and not an end in itself. When the problem is solved he wants the solution to apply to the ground, in order to produce "more game on the hoof." He is only interested in the practical application of the answer, and not to the problem itself. Attempts to solve problems of doubtful value to the individual sportsman should not be undertaken in the name of game conservation, regardless of their scientific interest, if the support of the mass of sportsmen to an adequate research program is to be expected.

In short, if we would build well, we must know our materials; their capabilities, limitations and uses. Without this knowledge, effort is frequently wasted and resort must be had to the trial-and-error method, which, while it may be necessary at times, is not generally to be recommended. It is slow, and not in step with modern efficient practices. The time element in the establishment of efficient methods for producing a game crop is most important. A species once extinct is gone forever.

3. Lack of Educated Man Power

To my mind, this is the crux of the whole matter. It might even be said in some truth that this lack of educated man power is the *only thing* wrong with game conservation. If we had it in sufficient quantities, all the faults we now find with the present system would be under study, and the problem would be in competent hands, from whom we could reasonably expect a solution.

I do not mean to infer there are no men educated in game work, or that they are not now doing well; there are, but their number is pitifully inadequate. They are recruited from the ranks of the forest rangers, from the by-ways and hedges, wherever they can be found. They are mostly self taught in the ways of game for the simple reason that until recently, no educational institution was turning out this man power. One desiring an education in game work could only get it in the school of experience at the expense of the general public. I do not refer to the chicken-wire, or artificial propagation method of game farming.

Compare the operations of game conservation with those of any large technical commercial concern—wild life conservation easily takes its place in the list of billion dollar businesses—and such a comparison will demonstrate clearly the lack of educated man power and the lack of research. Some of the technical concerns have given fellowships in universities, many of them maintain their own research laboratories and spend huge sums on research. If a commercial concern wants to go into quantity production on any product, they must have the "know how" and the educated man power to put that "know how" to work to produce the desired results. Leaving out all considerations of sentiment, we desire to put game, or wild life on a quantity production basis in every state, every county, every township in the nation and we have neither the "know how" nor the educated man power to put it across.

There are several classes of educated man power needed. (A) Scientific. (B) Administrative. (C) Technical. (D) Vocational. These arbitrary classifications are not, of necessity, absolutely correct. Classes C and D might be combined.

Class (A) Scientific, is available. How adequate the supply is we have no means of knowing. It certainly far exceeds the other classes and may, therefore, be dropped from present consideration. It might be noted in passing, that this class as a whole have no conception of the duties of the other classes, although all may be working for the same end, and lacking this comprehension, there is a lack of coordination of effort, for which the scientists are partially responsible.

Class (B) Administrative, is made up of state game officials and federal officials under whom wild life comes, such as the Biological Survey, National Parks Service, Forest Service, etc. Frequently these officials are picked for political reasons only, and do not know a single thing about wild life on taking office. They learn their jobs at the expense of the general public, and of the very wild life they are there to protect. Some, on taking office, do know what they are trying to do, but these are the exceptions rather than the rule. In due course of time when they have learned their important work, there comes a change in the political make up of the state or nation, and they are liable to be removed—for political considerations only—and the whole process starts all over again. Recently I attended a meeting of game officials; the main topic of conversation was the coming elections, and how many of them would be present at the next meeting. Under such a system, administrative decisions must be tempered with political considerations, and the carrying out of a progressive, continuing, long time policy is an utter impossibility.

Class (C) Technical, is now made up of the game wardens and a very few real technical men. In most states, unfortunately, the wardens are nothing but police to enforce the game laws; they are generally without training except in that phase of their work, and their selection is governed by the same political consideration which govern the selection of the higher game officials. Again, there are excellent men in this class, and again, they are the exception and not the rule.

Class (D) Vocational, does not exist. At times the game wardens do educational or extension work, and it is here the two classes (C) and (D) are similar. However, the full potential power of extension work, through county agents is not utilized, and as they are trained, they are not qualified to carry out this work. County agents now do game more harm than good.

4. Lack of An Accepted Game Policy

An American Game Policy was adopted by the 17th American Game Conference in December, 1930. This is a very able document and worthy of careful study. Perhaps it is a little soon to criticize, but it seems to me that up to the present time, this has remained only a document; which, however able, can do no good unless its provisions are put into effect. The Game Policy should be a guiding expression of beliefs, used in the development of a sound American game system, and changed only as the test of time determines. Its authors do not claim it to be perfect, but at least it is something tangible, and should become a living thing and not remain merely an academic expression of opinion.

No national policy can possibly be gotten up which will fit all the states and all the varying conditions in this wide land, unless it be in broad general terms. It can only prescribe principles, which must in turn be expressed in detail for each state. This indicates a continuing publically expressed state policy for every state; publicised so that all interested may know what it is, and so that it may have a chance of being carried out in the terrific political turnover of game officials already discussed.

5. Lack of Cooperation

There are so many opportunities for cooperative effort it is only necessary to outline a few to demonstrate the need for careful study so that the available potentials for good may be translated into action.

All the outdoors is a correlated whole. There is really no game conservation problem in itself. It is only such a problem to those interested in game alone, and to assume this attitude and fail to recognize other interests, is to make a narrow. unbalanced program which must fail to accomplish the best results from its own lack of stability. Game conservation is a part of the whole conservation movement, which takes in forestry, national parks, non-game species, fish and a host of other activities, amongst which has already been listed agriculture. As the aggregate of all these activities goes to the foundation of the economic life of the nation, the pursuit of so-called game conservation, to the exclusion of those interests to which it is related, is an attempt to make the tail wag the dog, to fly in the face of economic laws, and is doomed to failure.

To be more specific. The sportsman and the protectionist, for example, are constantly at logger heads when, at least in theory, they should be working in harmony. Impossible? It should not be. The same methods the sportsman must use to produce a game crop are the methods which will produce better crops of non-game species. After all, the two groups are in harmony until the hunting season, or the time of the harvest, then their ways may part. The plaint of the protectionist is that the sportsman is killing all the game species, and that they are in danger of extinction. What better way to assure the continuation of all species than to cooperate in the establishment of a productive system, stop all the present intolerance of the other fellows' views and do something constructive. Formulate a joint program lest the activities of each group nullify the activities of the other group, while wild life continues on the down grade. And, the sportsman is just as much to blame as the protectionist.

As the forests and fields are the habitat of game, cooperation between foresters, farmers and game men is essential. All agencies having any bearing on the subject should coordinate their activities in harmony with the big conservation movement. The building of one type of dam by the U. S. Army Engineers on the Mississippi might be of great benefit to fish, or in the establishment of feeding and resting areas for wild fowl. Another type might be the worst type possible for conservation. At present there is little cooperation, each bureau having an activity in charge, goes ahead and blandly carries out its own ideas without considering other interests. The tax payer, who supports them all, is the ultimate loser.

Cooperation between various conservation organizations is desirable, in fact essential, to any degree of success. The field is large enough for all, yet generally they are loth to undertake any cooperative action; possibly for fear they will "lose caste" with their own adherents, and not appear to be the "leading thought in conservation." This would be a serious matter from the dollar-and-cents standpoint. Conservation organizations, like the big political parties, have in the past seemed to thrive best on mud slinging. I have a sneaking suspicion that much of this lack of cooperation is due to a lack of understanding of what the problem is, by those who should know the most about it; or that real conservation is subordinated to the glory of the particular organization itself.

What Can We Do About It?

We can do a lot about it if we understand what we are trying to do and use a reasonable amount of brain work in building a sound conservation structure. What I have to say may sound a bit radical, may jar some of the old-line conservationists out of the ruts of their complacency. If it does this, so much the better. Old methods have failed to produce the success hoped for; something new must be tried. I have great faith in the ability of the American people to solve almost any problem when their united brain power begins to function. The speed with which this solution will be arrived at will be in proportion to the amount of brain power employed. There will be objections to any new method, certainly, but as Dr. Johnson has said: "Nothing will ever be attempted if all possible objections must first be overcome."

What to do then? First, get away from the idea so frequently expressed or implied amongst conservationists in their meetings, that they are the leading thought in conservation. This is naturally followed by an attempt to steer all activities along some preconceived lines. I will go so far as to say, that for the moment it is necessary for us to forget the fact we are conservationists, to quit dabbling in the details of conservation which could be better done by someone else, and get at the bigger and more immediately important jobs.

Wild life is a crop of the land. At present it is not being handled like a crop. If we would see results accomplished we must take the necessary steps to see that it is handled as all other crops are handled, and that provisions are made for constantly increasing the efficiency of method. This is not a conservation job except in so far as results go; it is an organization job and a big one, one we should all be about now.

As the accomplishment of much I have to say depends on the power of public opinion, the public must understand the problem as it exists. An educational program is thus indicated, and may be carried out through the combined cooperative effort of the sporting magazines, general magazines, press, radio, etc. The several state game administrations have educational means at their disposal through state publications and a willing press. Conservation organizations, working together on a common program, can wield great influence. Scientific societies can help, and the Senate Wild Life Committee can be of value in aiding to mould public opinion, and in finding means of putting out educational publicity through the channels at the command of the Federal Government.

Some of this is going on now, but not enough. I make the statement, incapable of proof, but which I believe true, that at least 66 2/3 per cent of the nearly seven million hunters have never heard the term "game conservation." To them, environmental control, game management and other phrases, bandied about in meetings such as this, are in a class with the Einstein theory. Yet without their support, success is improbable.

Adequate research must be organized, not only to carry out specific lines of study, but also to cover all problems arising as a matter of routine. We need facts on which to base a sound program, and on which to change policies and practices when these run contrary to natural and economic laws. We must provide the means for turning out educated man power, and recognize that this, the keystone of the arch, is not a conservation job, but one of organization.

These two most important factors of research and education may be provided for in the same place and at the same time. If game is a crop of the land, and if it is of great economic value to the state, there is already set up at the expense of these same people, the machinery for doing both these jobs, in the agricultural and forestry schools and colleges. If the existing facilities were put to work, each state would have at its command, the means for determining what was best for it to do. Game policies would not be hatched over a desk in some big city and rammed down the throats of the 48 states regardless. The state could turn out its educated man power in those quantities required and would not have to go outside its own borders for aid in solving its own problems. The land owner, the final custodian of the game, would learn what to do for this crop from those in whom he already has confidence. Game, as a secondary crop of the land, for which the demand is greater than the supply, would be on a sound economic basis.

This set-up potentially exists, but is a dormant potential which must be brought to life, and the only thing which can do this is an awakened public opinion based on a general knowledge of what the real problem is. Comparatively small minor groups, well organized, can turn the country upside down. The lovers of the outdoors, the hunters, the fishermen—all form a major group; the hunters and fishermen alone, numbering around fifteen million, could easily cause the various state legislatures to pass the necessary laws to mobilize the brains of the states to solve their problems, and to solve them without undue partiality to the desires or contentions of any particular group.

But if all these things were to become the main job of the conservationists, what would game be doing in the meantime? The same thing it is doing now, muddling through and getting scarcer and scarcer all the time. If we do these things, we will find we have conservation, on a sound basis, in our midst to stay, and methods will increase in efficiency as obscure details are cleared up.

An objection to this will be raised, and probably by the agricultural colleges themselves, that they do not know enough about the subject to teach game management or game administration. This may be true now, but in the light of present day forestry methods it is doubtful if the first forestry schools were efficient as soon as organized. They had to learn, and so must all educational institutions dealing with game. Surely there is no class of institutions better qualified to learn and to teach.

Is all this worth while? That is another problem, and reams of paper have been written on the economic value of the outdoors to the nation, and while it would be the first question to be answered, I believe the answer has already been found by those here. The wild life of the nation *is decidedly* worth while. If the job is worth doing at all, it is worth doing well. If it is the billion dollar business I believe it to be, and, as game belongs to the state until it is legally reduced to possession, then, you and I as voters, are stockholders in the huge concern which affects our own welfare and that of posterity. How much is generally known about how this business is conducted? How much does the purely political consideration govern game administration? Should we not demand that this business be carried on in the best manner possible?

In closing, let me emphasize these points:

That agriculture has been the subject of research for ages and the end point has not yet been reached. Do not let anyone tell you we know all that we need to know about game when little or no applied scientific research has ever been done.

That game is a crop of the land and should be handled as a crop.

That the foundation of the whole structure is educated man power. The faults found with conservation, and they were not all by any manner of means, were only brought in to demonstrate that we are faced with an organization job and not a conservation job as we now understand the terms. These faults will all disappear if we provide the educated man power.

That the machinery necessary to turn out educated man power and to do research already exists at the expense of the general public, and this can be put to work to place wild life on a quantity production basis just as soon as this general public demands it.

I do not believe the proposals outlined are too Utopian. True, it will be a long time before they will all come about and much that has been said may prove to be wrong. What of it? The principal is correct, and if the proof we are wrong is based on the operations of educated man power, we have our feet on the ground and we will be going somewhere.

Finally, if I have hurt the feelings of any of the conservationists, game men or scientists, I am sorry. I have nothing but the highest regard for them and for the work they are doing; this work has all been necessary to show what the next step is, but it is my firm conviction we are now facing the next step and that if we would keep up with the parade we must revise some of the older ideas. Wild life *must* be put on a productive basis.

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(Continued from Page 41)

to-date information is obvious and much has already been done to meet this necessity.

Further, the question of establishing and conducting a library for the Conservation Department wherein all library material of the Department may be kept, thus doing away with partial libraries in each division, has been investigated, and recommendations on this subject will be made to the Commissioner within a short time.

AN UNWARRANTED ATTACK ANSWERED

(Continued from Page 1)

lent. The official figures published by the United States Bureau of Fisheries in Washington, D. C., (Sette, 1925) covering the period from 1894 to 1922, and reporting the total market catch of Gaspergou for the Mississippi Basin alone give 4,478,620 pounds in 1894 and 4,539,165 pounds in 1922, with an average yearly catch for the period indicated of 3,930,522. The largest total United States catch of Gaspergou given in the official Bureau of Fisheries figures is 7,500,000 pounds for 1922. Such market production completely substantiates the fact that Gaspergou is a food fish of importance in the Mississippi Valley.

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Progress in Shrimp Investigations During the Year 1932

By MILTON J. LINDNER,
Acting in Charge, Shrimp Investigations,
U. S. Bureau of Fisheries

THE investigation of the shrimp, which ranks first on the list of the important fisheries in the South Atlantic and Gulf area, has been continued during 1932, under the direction of Dr. F. W. Weymouth, Professor of Physiology at Stanford University, California, and Mr. Milton J. Lindner. This investigation, started in 1931, covers practically the entire range of the commercial fishery and has been supported by the States of Louisiana, Texas and Georgia. Headquarters are maintained in New Orleans, the center of the shrimp industry, in quarters kindly furnished by the Louisiana Department of Conservation, and field stations are located at Beaufort, North Carolina, Brunswick, Georgia, and Aransas Pass, Texas. Intensive life history and oceanographic studies are being carried on in Louisiana, with the excellent cooperation of the Louisiana Department of Conservation, through its Bureau of Research and Statistics, Colonel Hu B. Myers, Director, and James Nelson Gowanloch, Chief Biologist. This Department, besides supplying quarters for the Bureau's investigators, also furnishes the crew and operating expenses of Fisheries Launch "Black Mallard." Through the generous support of the Texas Game, Fish and Oyster Commission and the Georgia Department of Game and Fish, the Bureau of Fisheries was enabled to place an observer at Aransas Pass, Texas, to sample the commercial shrimp catch, and another at Brunswick, Georgia, with Fisheries Launch 58 and crew, to study the habits of the shrimp in that area.

Commercial shrimp boats trawling in Louisiana. Shrimp are caught chiefly by craft such as these. The fisherman on the deck of the boat in the foreground is sorting his last haul; throwing overboard the small shrimp and "trash" fish.

As stated in the last annual report, the Bureau's Investigators confined themselves chiefly to the problems concerning (a) life histories of the principal commercial species, including feeding, spawning, embryology and larval history, postlarval growth, longevity and migrations; (b) abundance analyses; (c) biometrical studies of the principal species in respect to racial determinations and migrations; and (d) effect of fishing in relation to gear, localities and time on composition of the shrimp catch and on the other species of economic importance. The Investigators of the Louisiana Department of Conservation were to direct their activities toward the solution of the problems in respect to (a) habits and reactions of the young and adult shrimp in relation to food and food getting, migration, molting, spawning, temperature and salinity; (b) the anatomy of the principal species of shrimp in relation to spawning and feeding; and (c) diseases and parasites affecting the shrimp.

In an attempt to obtain these objectives, during 1932, in the region near Beaufort, North Carolina, 13 beam trawl and 76 otter trawl hauls were made for shrimp in both the inside and outside waters; 14 seine hauls were made for smaller postlarval shrimp in the muddy creeks and a number of plankton tows were taken in the waters adjacent to Beaufort, for the larval stages. Along the entire Georgia coast, Launch 58 made 362 hauls for shrimp with a regular fifty foot commercial otter trawl. Besides the otter trawl collections, a number of plankton tows and seine hauls were made. At Aransas Pass, Texas, 262 trawl boat catches were sampled. In Louisiana 188 otter trawl hauls, 106 plankton tows and 27 seine hauls were made. With each otter trawl haul an accompany-

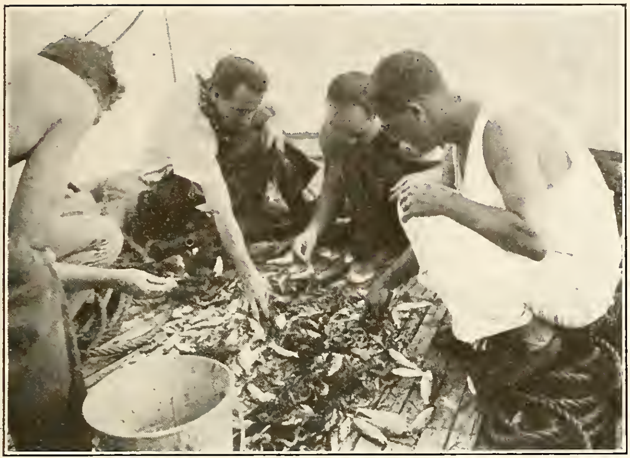


Fig. 2.—Sorting an experimental catch. When the haul or drag is completed the catch is emptied on deck and sorted, a sample of shrimp measured, and the number of each species of fish recorded.

ing hydrographic station was made. From the above operations, during 1932, over 85,000 shrimp were sexed, measured and the gonad development recorded.

The operations in Louisiana are centered around three stations in Barataria Bay and three stations in the Gulf adjacent to the Bay with occasional investigative trips to stations in other parts of the state. Barataria Bay is the focus of one of the most productive shrimping grounds in Louisiana and was selected as the base for intensive study because of its commercial importance and availability to New Orleans where the laboratories are located. The stations have been so chosen that they represent a wide variety of ecological conditions that grade from the brackish waters of Bayou St. Denis in upper Barataria Bay to the saline waters of the Gulf 12 miles off Barataria Pass.

The stations are visited twice every half month and at each an otter trawl haul is made, the surface and bottom water temperatures, salinity, and turpidity determined, and, if conditions are suitable, a plankton tow is taken. When the trawl haul is completed the catch is emptied on deck and separated into piles according to species. Each species of fish is counted and recorded and a random sample of 200 *Penaeus setiferus* (common shrimp) is taken. Each shrimp in the sample is sexed, measured and the gonad development noted. The measurements are made from the tip of the rostrum or "spine" to the end of the telson or "tailfin." They are taken to the nearest milimeter on an especially devised measuring board and recorded as total length. As the shrimp of lesser economic importance are found in the random samples of 200 common shrimp, they are separated out and later the same procedure of sexing, measuring and gonad examination is carried out on them. In this way the ratio of the common shrimp to other species in the catch is determined.

Somewhat similar sampling procedures are followed in both North Carolina and Georgia, but in Texas the method of sampling is altered to fit the commercial fishery. Here the observer is located at a cannery from which he obtains random samples of shrimp fro meight commercial trawl boats each week. The length measurements and other observations on the specimens are made in the same manner as in Louisiana.

There are three species of sea shrimp, all of which are members of the family *Penaeidae*, that are of commercial importance in the South Atlantic and Gulf states. The common shrimp or lake shrimp (*Penaeus setiferus*) comprises over 95 per cent of the total, while the grooved shrimp (*Penaeus brasiliensis*) and the sea bob (*Xiphopenaeus kroyeri*) together yield the remainder. Since the common shrimp (*Penaeus setiferus*) is by far the most important commercial species, the

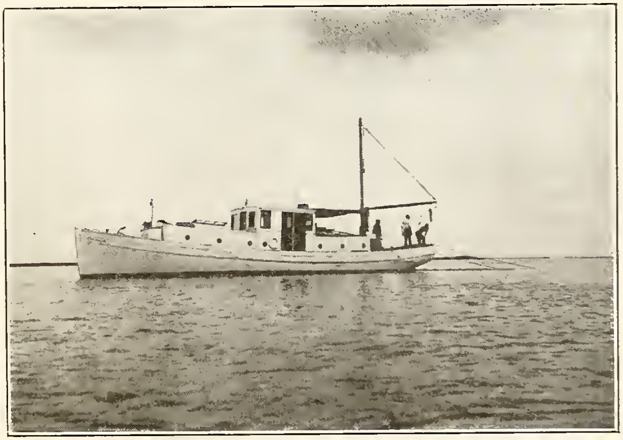


Fig. 3.—The research vessel, Black Mallard, making an experimental haul for shrimp in Louisiana.

investigations have been centered chiefly on solving the life history of this species. These investigations have already yielded many facts concerning the life history of the common shrimp (*Penaeus setiferus*) and a report is now in press covering some of the findings—a brief summary of the more important ones will be given here.

From an analysis of the length frequency data gathered in North Carolina, Georgia, Louisiana and Texas, it is evident that the common shrimp remains in the catch for only one year. In the Georgia area, the shrimp spawn from about the latter part of March until about the end of August. The young shrimp hatched in the spring, grow rapidly and appear in the fishery during July, with a mode at about 90 millimeters. These small shrimp-of-the-year furnish the heavy fall and early winter catch. The following spring they mature, spawn and pass from the fishery. By the first of October, there is none of these year-old shrimp remaining in the Georgia waters; they disappear rapidly during July, August and September, following the appearance of the young of the succeeding year class.

From all indications, the spawning seems to be in the outside waters or at least in waters of high salinity. The young postlarval stages, from 8 or 9 to 100 millimeters, are found in abundance on the inside in the bays, creeks and lakes associated with high temperatures, low salinities and shallow muddy-bottom waters. As these young individuals grow, they move to more saline waters.

There is a differential growth rate between the males and females with the latter outstripping the former. In the young shrimp, below 100 millimeters, there is but slight difference in length between the males and females, but by spring, in the spawning populations, the females average more than a centimeter longer than the males. There are also other morphological differences between the sexes; the males are characterized by having the inner ramus of the first pair of swimmerettes elongated and modified to form a structure termed the petasma which is apparently used in the transference of the spermatophores. This structure is lacking in the female.

That temperature influences the shrimp is evidenced by the fact that in Barataria Bay, Louisiana, during the fall of 1931, there was found a high positive correlation between the weekly average length of the shrimp and the average weekly air temperature. At the same time, there was a high negative correlation between the proportion of females in the catch and the temperature. In other words, an increase in air temperature was associated with an increase in the average length of the shrimp and a decrease in the proportion of females. Similarly a decrease in temperature was associated with a decrease in the average length of the shrimp and an increase in the proportion of females.

During the spawning season, there is evident a wide divergence in the proportion of sexes in the inside and outside waters of Georgia. From September, 1931, to March, 1932, the females were slightly more abundant than the males in both the inside and outside waters. Beginning about April (for both 1931 and 1932) the percentage of females on the inside rose rap-

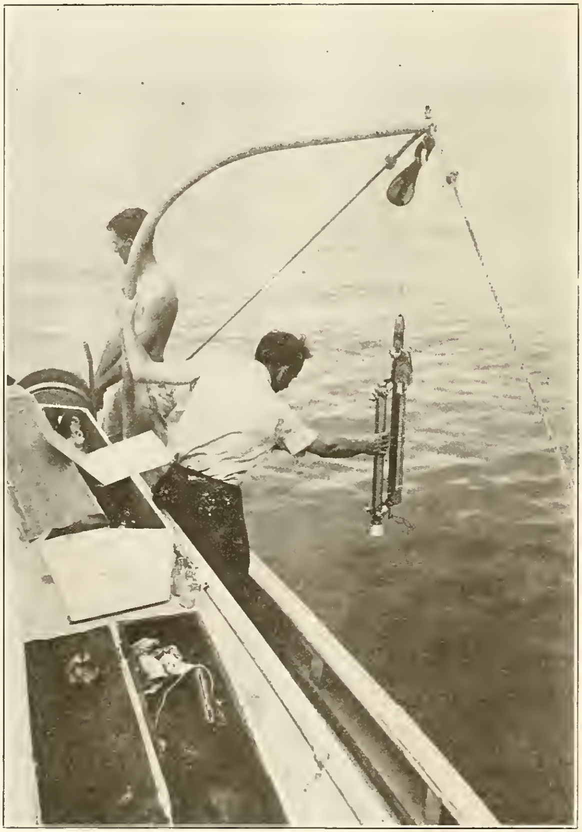


Fig. 4.—Raising the Greene-Bigelow water bottle and thermometer case. By this means accurate water samples and under-water temperatures are secured.

idly until by June over 80 per cent of the population in the inside waters was composed of this sex. After the June peak, the percentage dropped until the disappearance of the large year-old shrimp from the catch made it impossible to follow the sex-ratio of this group. During the period of rapid rise in the proportion of females on the inside, there was also a change in the proportion on the outside. At first there was a rise in the percentage of females then a rapid drop to about 30 per cent. where it remained until the large group disappeared.

For the first two months following the appearance of the young shrimp-of-the-year in the commercial catch, the males outnumbered the females in this group in both the outside and inside waters. That the rapid rise of the proportion of females on the inside and the decline on the outside was closely associated with spawning can hardly be doubted, as these changes in the population appeared during the height of the spawning season.

The shrimp is apparently omnivorous in its feeding habits as a wide variety of both plant and animal remains have been found in the stomachs.

In an attempt to determine the effect of trawling on species other than shrimp, an extensive survey was carried on for two years in Georgia. From October 1st, 1930, to September 30th, 1932, 386 hauls were made by Launch 58 in the inside tidal waters of Georgia suitable for commercial trawling operations (Similar studies are now in progress in Louisiana). In these 386 hauls made with the ordinary commercial gear, a total of 530,176 fish were taken, an average of 1373½ fish per haul. The table given below shows the total number and the average number per haul of Bullhead Minnows, important sports fish and all other species caught in these 386 hauls:

Species	Total Number of Fish Taken in 386 Hauls in Inside Waters	Average Number Fish Per Haul
Bullhead minnow	238,354	617.5
Spot	49,174	127.4
Croaker	45,809	118.7
Summer trout	25,952	67.2
Whiting	11,584	30.0
Bluefish	394	1.0
Other species	158,909	411.7
Total	530,176	1,373.5

As shown in the table, almost half the total catch (45%) was represented by the Bullhead Minnow (*Stellifer lanceolatus*), a fish of no sport or commercial value, but still of importance as a source of food for other species. Excluding the Bullhead Minnow, five sports fish, namely, Croaker (*Micropogon undulatus*), Spot (*Leiostomus xanthurus*), Summer Trout (*Cynoscion regalis*), Whiting (*Menticirrhus americanus*) and Bluefish (*Pomatomus saltatrix*) comprised 45½ per cent of the fish remaining. Since the majority of Summer Trout, Croakers, Spots and Bluefish, and a large proportion of the Whiting, were undersized and immature fish that could not be utilized for food purposes, it is evident that a great deal of destruction was done by the trawlers. In the ordinary commercial operations most of the fish and smaller shrimp caught in the trawls are dead or moribund before the process of sorting has been completed and they can again be returned to the water. If the young individuals are not dead they are so weakened from packing in the trawl and exposure on the deck of the vessel that when thrown back they fall easy prey to sea gulls and larger fish. Furthermore, since the inside waters of Georgia are restricted in extent and since they are important nursery grounds for shrimp and many species of fishes, it has been recommended that these inside waters be closed to trawling.

Experiments are in progress in Louisiana which it is hoped will throw light on the amount of shrimp that escape through the meshes of the trawl and to determine if it is feasible to devise a trawl which will allow the smaller shrimp to escape unharmed. This is not an easy undertaking as the shrimp are readily killed and their shape makes it difficult for them to pass through the meshes of a net without becoming entangled and badly mutilated. A canvas tubing is being devised which will fit over the cod end of a trawl and allow everything that passes through the trawl to be washed into a live car on the surface. With this apparatus the effectiveness of a savings gear can be determined as it will enable a record to be made not only of the number of shrimp and small fish escaping through the meshes of the trawl, but also whether these individuals are living or dead—a necessary requisite of any savings trawl.

With the shrimp fishery based wholly on immature and maturing individuals and with the evident short life of the common shrimp, it is apparent that when depletion once sets in it is likely to be disastrously rapid and all possible methods should be used to foresee depletion and prevent its occurrence. In Louisiana, steps toward this end have already been taken. Commissioner of Conservation, Robert S. Maestri, at the instigation of Mr. M. J. Lindner of the Bureau of Fisheries, and Colonel Hu B. Myers and Mr. James P. Guillot of the Department of Conservation, inaugurated a system of shrimp catch records which

(Continued on Page 56)

Louisiana's Gas Fields: History of Development and Possibilities

By M. E. NASH, Engineer Minerals Division,
La. State Conservation Department

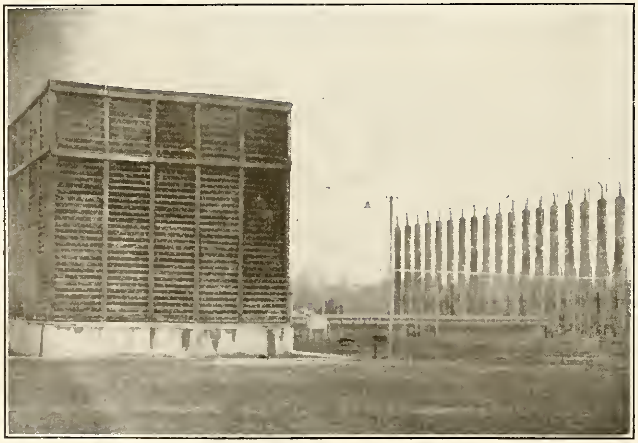
ABOUT the first we know of Natural Gas in Louisiana was written into a record of "Travels in New Spain" in the year 1804 by Baron Alexandria Von Humbolt. It was recorded as "popping Spring," located near the town of Flournoy in North Louisiana. The next indication was of utmost importance, as it was the result of actual drilling. In the year 1888 a well was drilled for artesian water in the city of Shreveport, and encountered gas. This well was used for a number of years for lighting purposes and as a result of this discovery we are told that several blocks of leases were obtained at various places for further prospecting: but failure to interest sufficient capital caused these leases to be dropped. This is the beginning of the history of Natural Gas in Louisiana, and today she is among the leading States in the production of this treasured product.

In 1909 Gas was discovered in what is now the Great Monroe Gas Field, but a really commercial well was not completed until 1916. There was no market for Natural Gas and no likelihood of one being developed until the Carbon Black operators were attracted to that area in 1918. This year was really the beginning of the Natural Gas Industry in Louisiana.

All of the gas produced in the State today is produced in North Louisiana. The major producing fields are Monroe, Richland, Sugar Creek, Rodessa, Waskom, and Pine Island. Innumerable smaller fields are scattered throughout the area; while the Monroe field is the oldest producing field in Louisiana, it will, no doubt, still produce more gas than any other field. It comprises approximately 227,000 acres and was originally estimated to have a potential of 3,768 billion cubic feet. At the close of 1931 the field had produced a total of 1,302 billion cubic feet. According to the 1932 regauge there were 850 producing wells in this field, with a total open flow capacity of 4½ billion cubic feet daily.

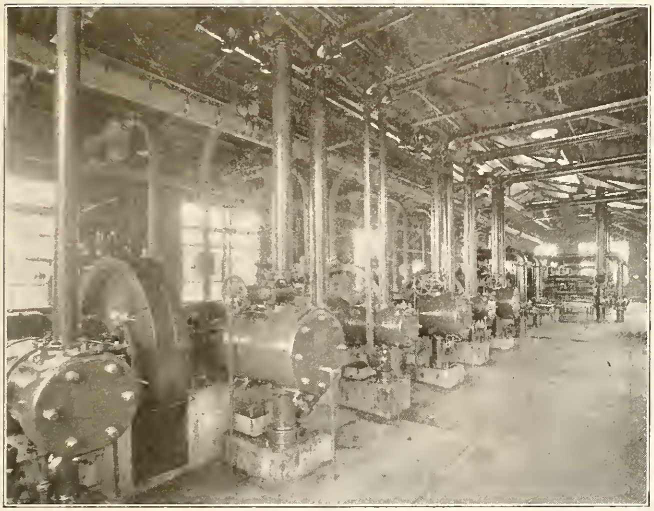
The Richland Gas Field, discovered in 1926 has been the second largest gas field in the state. While nothing to compare with the Monroe Field, it has contributed far more than its quota to the industry. It has today 239 producing wells capable of delivering 3,340,029,000 cubic feet daily, and comprising but 27,000 acres. Much of the Reserve of the Richland field was destroyed because of numerous craters. A high rock pressure together with faulty workmanship on several wells has proven disastrous to this field and from all indications it will within the next three years have been depleted, unless new interior wells are drilled, which is rather improbable at the present time.

Sugar Creek and Rodessa are without question the next outstanding fields in the state, and are very similar. Both are producing from the Trinity Horizon and both are exceedingly rich in gasoline, yielding approximately 1800 gallons of gasoline per million cubic feet of gas. Heavy withdrawals are not being made from these fields at present because of an insufficiency of gasoline plant capacity. Neither have the limits of the fields been defined. Sugar Creek is producing from a depth of 4300 to 4400 feet, while Rodessa is producing from 5600 to 5700 feet.



Right, A Battery of Absorbers for Extracting Gasoline from Natural Gas. Left, Condenser House or "still" where the Gas is cooled by Water System and the Gasoline Separated from it.

While many of the lesser outstanding fields of North Louisiana are still capable of producing a great deal of gas, they cannot be looked upon as a source of supply for any length of time, because the heavy withdrawals made upon



Interior View of Southern Carbon Company's Gasoline Plant at Fowler

them for the past several years have had a telling effect, which is muchly in evidence by the number of wells abandoned during 1932.

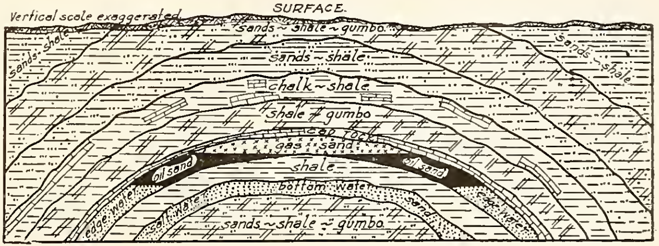
Production for all fields in Louisiana during 1932 amounted to 194 billion cubic feet as against 222 billion for 1931. This difference reduced to a percentage basis amounts to a 14.6% decline. The greater part of the decrease may be attributed to the slump in Carbon Black production, for but 40 billion cubic feet was used in 1932 as against 51 billion cubic feet in 1931. Also the discovery of the New Jackson, Mississippi Gas field has helped to lessen the load on Louisiana. Approximately 131 billion cubic feet of gas was put into pipe lines and transported to Texas, Missouri, Arkansas, Alabama and Tennessee for industrial and domestic consumption. An unusually mild winter throughout this state seems to have accounted for but a balance of 23 billion cubic feet, aside from the Carbon Black industry.

Since the production and transportation of Natural Gas became such an important spoke in the wheels of Progress, Louisiana has contributed by meter, a total of 2,302 billion cubic feet of gas, while no doubt an equal amount has been recklessly blown to the atmosphere, because of ignorance as to its value. However, since the Department of Conservation began to function, it has put into effect such laws and conservation measures that the situation is now under control, and an effort is made to prosecute all violators of these laws. It is quite safe to say that the present known gas reserves of the state are adequate for an additional twenty-five years supply.

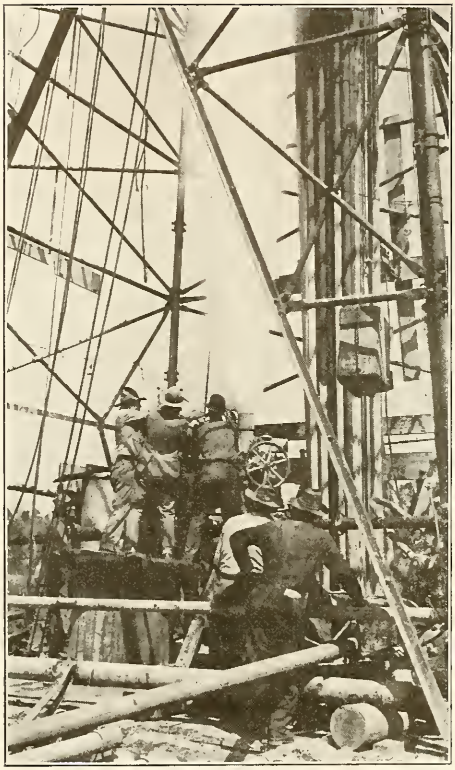
POSSIBILITY OF DEVELOPMENT

The area of Louisiana is 48,706 square miles or approximately 28,000,000 acres. It is quite conservative to say that of this vast expanse, less than 500,000 acres is known to be productive of gas. Also of the 64 Parishes which comprise the state, but 13 of these are productive of gas, and all in North Louisiana. There is still much undeveloped territory in North Louisiana that is without doubt worthy of exploitation, and which will be developed as the need for additional supply increases. East and West Carroll, Madison, Franklin, Tensas, Concordia and Catahoula, all in East and Northeast Louisiana are potential gas territories and have received considerable attention. Several "wildcat wells" are at the present time drilling at widely separated places in this area, and it is hoped that new discoveries will be made. But in the event of failures, the subsurface control that is afforded by these tests serve to enlighten the geological engineer and operator on the existence of more probable structures, and certainly there will be no cessation of activities for any length of time.

Central Louisiana from the Texas State Line to the Mississippi State Line is at present receiving the most attention. A strip or belt approximately 30 miles in width, running northeastwardly on a line from DeRidder, Louisiana to Jackson, Mississippi, known as the Conroe Trend, is the center of leasing activities as well as drilling. Vast



A typical occurrence of oil and gas in a Louisiana field



Guaging One of Louisiana's Many Monster Gas Wells

blocks of leases are being assembled by both Major and Independent Operator, and but little of the country is left unleased. Geophysical crews are working behind the leasing and of course much of the land now under lease will be dropped as its possibilities are disapproved by Geophysics. Since this is the same producing horizon as at Jackson, Mississippi, it would not be unfair to this territory to expect several new gas discoveries along this trend.

Vernon, Beauregard, Rapides, Grant, Avoyelles and Concordia are all contained in this new play. Much new and valuable information relative to subsurface conditions is being gleaned from operations therein, and some interesting shows have already been encountered.

At a recent meeting of the Shreveport Geological Society, it was decided that the annual field trip would be made through this area in an effort to work out a few of the details that might be helpful in future operations. This trip will be held the first week in June and a large attendance is expected as this will be an unusually interesting trip.

In conclusion it would seem that Louisiana has a very bright future despite the depression. Each week we find new faces and new money coming into the state, hoping to be able to recuperate from their losses elsewhere. And while Louisiana has lost her coveted fourth place among the gas producing states, the interest that seems centered here, together with a vast unexplored and potential territory, we feel certain that ere long this place will be regained if not exceeded.

PROGRESS IN SHRIMP INVESTIGATION

(Continued from Page 53)

will eventually yield invaluable information on the abundance of the shrimp. It is required of all dealers and ice-boat captains, or anyone who buys shrimp directly from the fishermen, to fill out a form, in triplicate, giving the name of the dealer, the name of the fishermen, the name of the boat, the type and size of net used, the locality in which the shrimp were caught, the amount of shrimp and the price paid. These forms are furnished free by the State to all dealers, and the field agents of the Department of Conservation collect the completed tickets twice each month. It is hoped that the other States in which shrimping is an industry will follow the excellent example set by Louisiana in securing information on the status of the fishery, for it is only from such records that sufficient information can be obtained to determine the real abundance of shrimp.

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Process of Formation of Caves of Kentucky

Effects of Limestone Erosion and Development of Natural Curiosities by Chemical Actions of Underground Streams Explained

By ARTHUR C. McFARLAN
Geologist, Commonwealth of Kentucky

THERE are two principal cave areas in Kentucky. The better known and better developed western region includes such well-known caves as Mammoth, New Entrance to Mammoth, Floyd Collins, Crystal, Great Onyx, Mammoth Onyx, Diamond, and Hidden River caves. A less extensive region includes the Carter Caves and Cascade Cavern.

To build some sort of a picture of the geological background of the cave region, one must picture a great series of rock strata many hundreds of feet thick, comprising the earth's crust in that region, made of consolidated sediment. This great mass of rock has been gently bowed up in the central part of the State, so that the process of erosion has been able to cut deeply into it, exposing on the surface in the Bluegrass the older strata which underlie regions to the east, south and west.

Successively younger and younger beds of rock are found underlying the surface as one goes outward from the central Bluegrass. One great sheet of limestone, outcropping over a broad area forming a ring about the Bluegrass, has been completely stripped from the surface of the Bluegrass and underlies the younger beds of the eastern and western coal fields.

This sheet of limestone has a thickness in the western area of about 600 feet, and to the northeast about 100 feet. The Kentucky caves are restricted to the area of outcrop of this limestone.

Occasionally a guide will point out, a visitor will notice, in these massive limestone layers, the remains of prehistoric life, the shells of marine animals of many kinds which in their very abundance have made up these limestone layers. In these beds and their contained fossils one reads a story of prehistoric Kentucky, the bottom of a shallow sea, in which a myriad of organisms lived, a small representation of which is found in these fossils.

The accumulation of shells on this sea bottom year after year through vast periods of time marked the building of these limestone layers and the setting of the stage for the development of the cave region. Scientific study has indicated an antiquity for this seaway of something like 300,000,000 years.

Limestone regions are cave regions. Cave regions are always limestone regions.

Of all the water which falls on the earth's surface a considerable part sinks underground and becomes a part of what we may term the ground water circulation. Following whatever available path, crevice, bedding plane, or the minute pores of the rock, the water journeys on until sooner or later it again emerges on the land surface as a spring.

Of all of the common types of rock comprising the earth's crust, limestone is the most readily dissolved by this water. That is not saying that limestone is readily dissolved by water, as it takes about 75,000 parts of pure water to dissolve a single part of limestone, or lime carbonate. But ground water, far from being pure, is essentially a very dilute solution of carbonic acid, from carbon dioxide taken from the atmosphere and from decaying organic matter in the soil, and is thereby 30 times as effective as a solvent.

The water which falls on the surface of one acre in the Mammoth Cave region over a period of one year is capable of dissolving 25 cubic feet of limestone, and the land is being lowered thereby at the rate of something like a foot in 2,000 years. The oldest known rocks have an antiquity of around 1,500,000,000 years.

Ground water follows whatever openings are available in the rock, most evident of which are the more or less vertical crevices, called joints, and the partings between the individual layers of rock, the bedding planes. Slowly, this seepage dissolves the limestone walls of the crevice, gradually enlarging them and forming an irregular network of solution channels in the limestone.

The enlargement of these channels by solution gradually permits the concentration of the water into underground streams and the work of ordinary stream erosion is inaugurated and the underground passageways are enlarged in much the same manner as valleys on the surface. The caving in of unsupported rock masses on the ceiling and walls adds to it.

These underground streams find their way back to the surface again as large springs in some of the deeper valleys. As the active circulation of this water is restricted to the level above such valley bottoms, the process of cave formation is thus necessarily restricted by, and must work hand in hand with, valley deepening on the outside. Gradually as such valleys are deepened cave formation extends on down to deeper levels and much of the work is abandoned in the higher and drier levels.

Interest of the visitor is about equally divided between those features formed through solution and stream erosion, and those formed through the deposition of mineral matter. The erosional features include many impressive spectacles, but it is in the depositional features that beauty is found.

Joints and bedding planes offer the main guides to ground water circulation. Most of the passage ways have been opened along these; those along the former characterized by their narrow, high configuration, and the latter by their great width and relatively low flat ceiling.

The Grand Canyon of Floyd Collins Crystal Cave is a deep, narrow passage with vertical walls and flat ceiling, more than 100 feet high and about one-eighth of a mile long. Here we have really two passageways, one above the other, in which the stream occupying the upper level has cut through to the lower and joined them, the erosion being controlled by jointing.

The Cathedral Domes of the New Entrance part of Mammoth Cave is a deep, narrow pit down through which the tourist descends by stairway. The lack of linear extent in this erosional feature is due to local concentration of the work at the intersection of two joints.

The X Cave of the Carter Caves is characterized by the intersection—hence the X—of two narrow passageways of the type developed along joints. Thus erosion concentrated along a pair of intersecting joints.

The Bottomless Pit of Mammoth Cave is hardly bottomless; and again excessive and localized erosion.

The Fat Man's Misery—all parts of a passageway are not of the same size, and that applies to this one.

The Giant's Coffin of Mammoth Cave is a large, appropriately shaped block, fallen from the roof as erosion gradually removed the supporting rock beneath. Neither this nor the Tilted Rocks are the product of earthquakes; just erosion.

The Chinese Temple of Cascade Cavern is again erosion along a joint, and carved rather suggestively by solution.

Martha Washington's Statue, of Mammoth Cave, is not a product of deposition but the overlapping walls of a passageway to leave a small opening very suggestive in its form when light shows through from beyond.

These are only a few samples selected at random and various and varied forms of this type are countless, and known to countless names.

Just as nature opens up these passages, so does she also attempt to heel the wounds produced. As the active removal of material passes on to lower levels, water seeping through the joints in the roof, through the rock itself, or along the walls, evaporates, and there is deposited the mineral carried along in solution.

Where did the mineral matter come from? It was obtained from the rock through which the water had already passed. This includes the various forms of travertine, a form of limestone, also known as cave onyx, gypsum, and occasionally other minerals. Some of the onyx takes a handsome polish, but because of its softness is not durable.

The form taken by the travertine varies. Successive drops oozing through the ceiling and evaporating build along icicle-like forms, the stalactites. The growing drops, partly evaporated, fall to the floor and under each stalactite there is built up a stalagmite.

If the water is dripping rather rapidly the stalagmite grows the more rapidly; if slowly the bulk of the mineral matter is left on the ceiling. Continued growth and the gap between shrinks until the two coalesce into a pillar.

The dripping on the ceiling is concentrated along any joints present, hence a strong tendency for the stalactites to grow in long lines or rows. Continued growth causes adjoining ones to coalesce, giving a flattened pendant; and continuation of this process gives rise to such features as displayed in Drapery Dome of Great Onyx Cave.

Many are the freak forms produced, to each of which is assigned a name. Thus, the Cat of Mammoth Cave, a large stalagmite of suitable shape to simulate a tabby sitting, whose growth was stopped apparently by the breaking off of the feeding stalactite above, only to resume again by dripping from two small stalactites to produce the ears, each a miniature stalagmite growing on the older one.

Again, the Bunch of Onyx Bananas of Mammoth Onyx Cave, a large bunch of stalactites as part of a bench formation on the wall, clustered so as to create the resemblance. The Hornet's Nest in the same cave is equally striking. The Arm Chair of Mammoth Cave is well named a stalagmitic growth, or rather several coalesced.

Really beautiful but not named for any striking resemblance to some object is the assemblage of stalactites and stalagmites seen in the Blue Grotto, or King Tut's Tomb, of the New Entrance to Mammoth, and Violet City of Mammoth Cave.

The onyx may be found coating the floor and walls in various forms, or the mineral may occur as crystals on the wall and ceiling. The nice development of these on a ceiling stained black by manganese dioxide gives the Star Chamber of the Mammoth Cave.

A modification of the stalactite is the beautiful Helectite, a great irregularity and complexity of growth, varying from those which are stalactites with the end upturned to others, which have the complexity of the antlers of an Irish elk. There is nothing more beautiful.

The gypsum deposits are just about in a class by themselves in their soft white or light brown color. Growing on the walls and ceiling as a thin coating, more is gradually added at the base of the growing crystals, and as these push outward rounded bulges on the surface break into beautiful rosettes and long feathery flowers, and nothing is quite as delicate nor quite as beautiful.

The growth of these crystals can be readily visualized by recalling the sprouting up of ice crystals in loose soil during a severe freeze. Thus, the remarkable passageways of both parts of Mammoth Cave, Floyd Collins' Crystal Cave, and Great Onyx Cave, are dark underground passages lined with these gypsum rosettes, flowers, snowballs, needles, feathers, and what not.

The source of gypsum is to be found in the occurrence of pyrite, or fool's gold, in overlying strata, and it is to be noted that the occurrence is only in the drier parts of the cave. Too rapid ground water circulation with gypsum will not do.

Mention must be made of the nitrate deposits and workings found in Mammoth Cave and Carter Cave, both exploited in the War of 1812. Similar cave deposits were exploited by the South during the Civil War.

MY PAL

My Pal was just a pointer
Of no very high degree,
But blue blood or royal lineage
Would have made him no more dear to me.
We roamed the wood and marsh land,
We frolicked on the strand.
His every action mine to command.
When I was sick and ailing
With his great love unfailing
Into my room a' stealing
He'd come; his great brown eyes appealing
Seemed to say:
"My love for you, Dear Master,
Grows greater day by day."
I've grown old and ugly,
What hair I have, is gray.
I command little human love can sway.
But when that old brown head lay snugly
At rest upon my knee,
I knew that nothing living could take
My pointer's love from me.
Nobody but a fool
Would ever ridicule
A sportsman's love for the dog
That was given him by God;
So when the great Creator
My life does take away,
I hope and humbly pray
That in the glorious hereafter
I may hold up my head and say,
"My love for you, Dear Master,
Is greater than my pointer's love for me."
Now that the Heavenly Master
Has taken him away: To me
Somehow the world seems sad and gray;
Vainly I seem to hark
For the sound of a joyous bark
As my pal meets me at the door
And drops my slippers on the floor.
No longer will I see him swing
To a point, and "freeze"
As he picks the game scent from the breeze.
No longer will I call,
On some bright day in the fall,
"Steady, boy, steady;
Master's here, and ready."
So does it seem strange to you
That I'm feeling sad and blue?
For after all is done and said,
A faithful, loyal friend, my pal, my dog, is dead!

E. B. COPE.

Louisiana Nature Guardians

"Upon my honor, as a Louisiana Nature Guardian, I promise to take care of all our natural friends, to guard and protect them to the best of my ability, and as far as possible influence others to do the same."

ESTELLE VIRJIE COTTMAN, *Editor*

WHEN the Nature Guardian Club of Louisiana was formed several years ago, it met an instant and hearty response from the teachers and the school children all over the State. From a small interested group it has grown steadily into a mighty force of thousands of young conservationists. These children are the proud possessors of handsome lithographed badges, and certificates of membership. New Clubs are being formed each week and it is the purpose of the Educational Bureau to enroll every Louisiana boy and girl, white or colored, under the Nature Guardian banner.

HOW YOU CAN BECOME A NATURE GUARDIAN

YOUR PART

Consult your teacher.

Ask that the purpose and plans of the Nature Guardian Club be explained to you and the class.

Ask for an application card.

Get a responsible person to indorse it, after proving that you fully understand the duties of a Nature Guardian.

Sign the application and mail the card postpaid, or give to your teacher, to send with card from all the class.

OUR PART

We send the application card.

We send you a handsome badge, a certificate of membership, Nature Guardian pamphlets, and other literature.

This is all free, and is carried on with the purpose of instilling in the children's minds a knowledge of Louisiana's wild life and a thorough understanding of its economic value to the State.

It also aims to develop individual humanitarianism. Even within this short time an amazing improvement has been made in the mental attitude of our young folks toward the conservation and protection of Louisiana's natural resources.

EDITORIAL

MY DEAR GUARDIANS:

By the time this is printed Springtime will be weaving her spells over Louisiana woods and marshlands! Truly, this State of ours has been greatly blessed by Nature!

Perhaps your teachers will take you for an early picnic or for a long stroll in the woods, and you will know the joy of seeing the first leaf and flower buds of the year, of hearing the first happy notes of the mocking birds and the meadow larks, of noticing the soft white clouds that "hang in glory in the sky."

I wish all Guardians would open their hearts and minds to an appreciation of these natural objects of beauty and usefulness, and develop a loving sympathy toward all living creatures, and an intense desire to protect and conserve them. What an opportunity there is for the hundreds of earnest Louisiana teachers to broaden the interest of their pupils in the varied animate and inanimate natural forms, and to lead their boys and girls "from Nature up to Nature's God."

With love and best wishes for all the Guardians,

THE EDITOR.

Here is a poem that comes all the way from Illinois:

THE BUTTERFLY'S SONG

Betty Cline

Here is a lily and there is a rose,
From each of these flowers the good honey flows,
So for dinner I'll drain them well; then I will doze.

Poppy and violet, clover and bay,
With yellow nasturtiums just over the way,
Oh, what a banquet I have every day!

I am so grateful that God doth provide,
For all of His creatures that on earth reside,
The things that they need and great beauty beside.

Pearl Nelson sends in these Bird Puzzles:
What bird is a good mouser?
What bird needs cheering up?
What bird is a color?
What bird is a mimic?
What bird is part of a fence?
What bird could be used in the dairy?
What bird do we think of when eating?
What bird would make a good street cleaner?
What bird is silly?
What bird reminds us of heaven?
What bird is a "hill Billy?"
How many of these can you guess, Guardians?

Poems seem to be the style this month!

Castor, La.

Dear Editor:

I am a member of the Nature Guardian Club, and I am interested in literature about Louisiana. I am writing a little poem for our column:

PROTECT OUR TREES

Smoke was curling over the trees,
A hard wind swept the pale green leaves.
A sound like that of the hurricane's roar
The echoes carried o'er and o'er.

Terrified animals ran toward the lake
Looking behind them as if to make
Their slower companions hurry on
To safety away from their burning home.

The fire swept on from a forest bare,
Ruin and havoc everywhere.
You see the destruction a forest fire leaves,
So help us protect our forest trees!

Yours truly,
Minnie Mae McInnes.

Here is a letter from one of our most enthusiastic honorary members from St. Louis:

8553 Park Lane,
St. Louis, Mo.

Dear Editor:

While paging through various books today concerning nature, I was astonished at the many parts it has in connection with the world.

Nature plays a big part in forming originality in architecture. Centuries ago Greece, Rome, and even as far back as Egypt have derived their originality from nature. For example, lotus beans added beauty in design to the beautiful columns. That is, the leaf itself was not used but the actual form was copied by the sculptors and cut out on the stone entablature itself.

But let us go back still farther. Nature, at one time, was man's most precious helper. The first habitations devised by man were bowers in the forests, and from his observance of the habits of inferior animals, caves were hollowed in the earth.

We, of the present civilization, do not intend to get that close to nature, but we should preserve and respect it as the men of centuries ago did. The cave man respected nature because it furnished him a home and protection; we of the "Nature Club" respect it because we wish to further conservation by letting it be as Mother Nature would have it.

Lastly, let me thank the Louisiana Nature Club for accepting me as a member.

Fred Greulich.

IN BLOSSOM TIME

By Tessa Sweazy Webb

In blossom time the world again
Is filtered with a faint perfume
The sensuous orchid leaps to bloom
Beneath the resonance of rain.
The crimson tulips leave a stain
Upon translucent April's tomb
In blossom time.

The Soul of Spring sips every vein;
As charm and loveliness illume
The quiet loam from winter's gloom.
And beauty snares us in her chain
In blossom time.

Everything seems to savor of Springtime. Here is a poem and an application. We are glad to welcome a new member:

Route No. 3, Box 72A,
Shreveport, La.

Dear Editor:

I am very interested in Nature, and am a member of a Nature Club. I am fifteen years old, and study civics in high school. I want to become a member of the Louisiana Nature Guardian Club, so please send me an application card.

I also thank you for the magazine you are sending to us. Here is a poem I have in mind:

Here it is nearly spring.
I sit thinking of the joy
It will bring.
The joy of the beautiful birds
And wonderful flowers.
I often wonder if there
Are any better than ours.
I know that we all think
That our state is best,
But for me Louisiana
Surpasses the rest.

Yours truly,
O. C. Holder.

I wonder how many of the Guardians know the painted bunting or the nonpareil! It is a bird upon whose plumage Nature has lavished her richest colors. In the Southern part of the State they are known as "pops." However, the correct spelling is "pape," the French for Pope. The name "nonpareil" means "none can equal." This is the best known of all the "pops," and is the gaudiest of all North American birds. Dr. Chapman mentions the following colors as decorating its pretty feathers: indigo, gold, blue, green, dull red, and bright red.

These bright creatures live alike in city and country, in lawns and gardens, and in brushy pastures and thickets, but never in thick, heavy woods.

The song of the nonpareil is short, loud, and clear. Its pleasing notes are heard early in the morning, and a Guardian who get up reasonably early during May and June is almost certain to hear him call "Pew-eata, Pew-eata, I eat—you—too!" as he balances himself on the topmost branch of a tall tree.

Two broods are raised each year, in a nest built close to the ground in some thicket or stunted tree. Louisiana offers bountiful food and fine nesting places for these beautiful birds.

LILIES

In the balmy springtime season
There's a fragrance in the air,
And a strange pervading sweetness
Sends its gladness everywhere.
Lilies with their spotless beauty
Flaunting in the golden light
Emanate a lasting incense
From their petals snowy white.

Other blossoms are enchanting
With their strange seductive joy,
Something in their magic perfume
Passing years cannot destroy,
There's the jonquil and narcissus
There are tulips red and fair,
But these cannot hold the beauty
Of the lily white and rare.

Balmy April with its lilies,
That create the Springtime charm;
Nothing in the world of nature
Seems so free from guile and harm.
As I look upon the lily
To my mind it dies impart
Purity from every petal,
And a virtue from its heart.

T. A. W.

DO YOU KNOW THAT—

The CACIQUE, a bird of South America, is said to build a nest six feet long?

The GREAT BLUE HERON is the largest true American heron?

The WOODPECKERS are the natural guardians of the forests?

The BLUEBIRD is one of the most domestic of our wild birds?

The SATIN BOWER BIRDS decorate their nests with bright shells and stones?

The MOCKINGBIRD sings sweetest in the Springtime?

When courting the FLICKER spreads its wings and tail and bobs about?

The Mexicans call the TOWHEE "viejita"?

Audubon named the BEWICK WREN for an English writer and wood engraver?

Here is a letter from a dear little girl, who sends me a photograph of herself, her brother, and her little sister. What a pretty group it is!

Eunice, La.
January, 1933.

Mrs. Estelle Virgie Cottman,

Dear Editor:

It is with pleasure that I have the chance to write and ask you to send me an application card for me to join Louisiana Nature Guardians. I feel that I could do my duty in protecting nature and wild life in our dear Louisiana. I will get my father to endorse my card, after I understand a Guardian's promise. My father, whose name is Marvin Young, is deeply grateful to you as he is sure you were the kind lady who placed his name on the Conservation Review mailing list.

I will try to compose a little poem later on when I understand more about my duties as a Nature Guardian.

I am respectfully,

(Signed) Marie Young,
Box 673.

We extend a hearty welcome to all of our new members, and hope they will become happy, useful, and faithful Guardians.

We shall be glad to hear from our members at any time, and shall be glad to print their poems, themes, and letters about any of the natural resources of Louisiana. We hope that our next issue will contain many interesting articles by members of our Club.

Address all letters to: NATURE GUARDIAN EDITOR, DEPARTMENT OF CONSERVATION, New Court Building, New Orleans, La.

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